Exhibit 5

THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Arndt Mueller	
U.S. Patent No.:	8,363,681	Attorney Docket No.: 45035-0035IP1
Issue Date:	January 29, 2013	
Appl. Serial No.:	12/580,127	
Filing Date:	October 15, 2009	
Title:	METHOD AND APPARATUS FOR USING RANGING MEASUREMENTS IN A MULTIMEDIA HOME NETWORK	

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PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,363,681 PURSUANT TO 35 U.S.C. §§311-319, 37 C.F.R. §42

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DISH-1004	Curriculum Vitae of Dr. Scott Acton
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DISH-1006	U.S. Patent Appl. Pub. No. 2008/0101253 A1 to Shvodian ("Shvodian")
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DISH-1009	U.S. Patent No. 7,821,958 B2 to Smith et al. ("Smith")
DISH-1010	Declaration of June Munford
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DISH-1012	Huang, R.Y., & Hooten, P. (1971, February). Communication Satellite Processing Repeaters. Proceedings of the IEEE, 59(2), 238-252 ("Huang")
DISH-1013	U.S. Provisional Application 61/144,676 to Mueller et al. ("'676 Provisional")

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LISTING OF CHALLENGED CLAIMS

Claim 1	
[1.pre]	A method for synchronizing a plurality of nodes on a communication network, comprising:
[1.a]	exchanging a local clock time between a first node and a second node over the communication network, wherein the exchange comprises:
[1.a.i]	transmitting a first packet from the first node to the second node, wherein the first packet includes a first packet clock time set to the local clock time of the first node at transmission time, and includes a scheduled arrival clock time, and
[1.a.ii]	setting the local clock time of the second node to the first packet clock time;
[1.b]	performing a ranging method between the first and second nodes based on the local clock time exchanged, wherein the ranging method results in an estimated propagation delay between the first and second node, and wherein the ranging method comprises:
[1.b.i]	transmitting a second packet from the second node to the first node, wherein the second packet is transmitted from the second node at the

	scheduled arrival clock time, and wherein the second packet is received by the first node at an actual arrival clock time,
[1.b.ii]	calculating and storing the estimated propagation delay at the first node, wherein calculating the estimated propagation delay is based on the scheduled arrival clock time and the actual arrival time, and
[1.b.iii]	transmitting a third packet from the first node to the second node, wherein the third packet comprises the estimated propagation delay; and
[1.c]	adjusting the local clock time of either the first or second node based on the estimated propagation delay, thereby resulting in a synchronized local clock time between the first and second node.
Claim 2	
[2]	The method of claim 1, further comprising using the synchronized local clock time in subsequent packet transmissions between the first and second nodes.
Claim 3	
[3]	The method of claim 1, wherein adjusting the local clock times comprises storing the estimated propagation delay at the second node.
Claim 4	

[4]	The method of claim 1, wherein a transmission time of a transmitted packet is measured at 90% of peak amplitude of a transmission signal, 90% of peak power of a transmission signal, 90% of total power of a transmission signal, or a mean delay of a transmission signal.
Claim 5	
[5]	The method of claim 1, wherein an arrival time of a received packet is measured at 90% of peak amplitude of a received signal, 90% of peak power of a received signal, 90% of total power of a received signal, or a mean delay of a received signal.
Claim 6	
[6]	The method of claim 1, wherein the first node is a network coordinator.
Claim 7	
[7]	The method of claim 1, wherein the second node is a new node and the method is performed as part of admission of the second node to the communication network.
Claim 8	
[8]	The method of claim 1, wherein the method is performed periodically to maintain synchronization between the first and second nodes.
Claim 9	

[9]	The method of claim 1, wherein the communication network is a mesh network.
Claim 10	
[10]	The method of claim 1, wherein the communication network operates in accordance with a Multimedia over Coax Alliance (MoCA) standard.
Claim 11	
[11.pre]	A network device, comprising:
[11.a]	a controller;
[11.b]	a device module;
[11.c]	memory coupled to the controller;
[11.d]	computer executable program code on a non-transitory computer readable medium configured to cause the controller to perform the functions of:
[11.e]	exchanging local clock times between a first node and a second node over a communication network, wherein the exchange comprises:
[11.e.i]	transmitting a first packet from the first node to the second node, wherein the first packet includes a first packet clock time set to the

	local clock time of the first node at transmission time, and includes a scheduled arrival clock time, and
[11.e.ii]	setting the local clock time of the second node to the first packet clock time;
[11.f]	performing a ranging method between the first and second nodes based on the local clock times exchanged between the first and second nodes, wherein the ranging method results in an estimated propagation delay between the first and second nodes, and wherein the ranging method comprises:
[11.f.i]	transmitting a second packet from the second node to the first node, wherein the second packet is transmitted from the second node at the scheduled arrival clock time, and wherein the second packet is received by the first node at an actual arrival clock time,
[11.f.ii]	calculating and storing the estimated propagation delay at the first node, wherein calculating the estimated propagation delay is based on the scheduled arrival clock time and the actual arrival time, and
[11.f.iii]	transmitting a third packet from the first node to the second node, wherein the third packet comprises the estimated propagation delay; and

[11.g]	adjusting the local clock times of either the first and second nodes based on the estimated propagation delay, thereby resulting in a synchronized local clock time at the first and second nodes.
Claim 12	
[12]	The network device of claim 11, wherein the computer executable program code is further configured to cause the controller to use the synchronized local clock time in subsequent packet transmissions between the first and second nodes.
Claim 13	
[13]	The network device of claim 11, wherein adjusting the local clock times comprises storing the estimated propagation delay at the second node.
Claim 14	
[14]	The network device of claim 11, wherein a transmission time of a transmitted packet is measured at 90% of peak amplitude of a transmission signal, 90% of peak power of a transmission signal, 90% of total power of a transmission signal, or a mean delay of a transmission signal.

Claim 15	
[15]	The network device of claim 11, wherein an arrival time of a received packet is measured at 90% of peak amplitude of a received signal, 90% of peak power of a received signal, 90% of total power of a received signal, or a mean delay of a received signal.
Claim 16	
[16]	The network device of claim 11, wherein the first node is a network coordinator.
Claim 17	
[17]	The network device of claim 11, wherein the second node is a new node and the functions are performed as part of admission of the second node to the communication network.
Claim 18	
[18]	The network device of claim 11, wherein the functions of exchanging local clock times, performing the ranging method, and adjusting the local clock times are performed periodically to maintain synchronization between the first and second nodes.

Claim 19	
[19]	The network device of claim 11, wherein the communication network is a mesh network.
Claim 20	
[20]	The network device of claim 11, wherein the communication network operates in accordance with a Multimedia over Coax Alliance (MoCA) standard.
Claim 21	
[21.pre]	A computer program product comprising a non-transitory computer usable medium having computer readable program code embodied therein for synchronizing a plurality of nodes on a communication network, the compute program product comprising computer readable program code configured to cause a device to:
[21.a]	exchange local clock times between a first node and a second node over a communication network, wherein the exchange comprises:
[21.a.i]	transmitting a first packet from the first node to the second node, wherein the first packet includes a first packet clock time set to the local clock time of the first node at transmission time, and includes a scheduled arrival clock time, and

[21.a.ii]	setting the local clock time of the second node to the first packet clock time;
[21.b]	perform a ranging method between the first and second nodes based on the local clock times exchanged between the first and second nodes, wherein the ranging method results in an estimated propagation delay between the first and second nodes, and wherein the ranging method comprises:
[21.b.i]	transmitting a second packet from the second node to the first node, wherein the second packet is transmitted from the second node at the scheduled arrival clock time, and wherein the second packet is received by the first node at an actual arrival clock time,
[21.b.ii]	calculating and storing the estimated propagation delay at the first node, wherein calculating the estimated propagation delay is based on the scheduled arrival clock time and the actual arrival time, and
[21.b.iii]	transmitting a third packet from the first node to the second node, wherein the third packet comprises the estimated propagation delay; and

[21.c]	adjust the local clock times of either the first and second nodes based on the estimated propagation delay, thereby resulting in a synchronized local clock time at the first and second nodes.
Claim 22	
[22]	The computer program product of claim 21, wherein the computer executable program code is further configured to cause the device to use the synchronized local clock time in subsequent packet transmissions between the first and second nodes.
Claim 23	
[23]	The computer program product of claim 21, wherein adjusting the local clock times comprises storing the estimated propagation delay at the second node.
Claim 24	
[24]	The computer program product of claim 21, wherein a transmission time of a transmitted packet is measured at 90% of peak amplitude of a transmission signal, 90% of peak power of a transmission signal, 90% of total power of a transmission signal, or a mean delay of a transmission signal.
Claim 25	

[25]	The computer program product of claim 21, wherein an arrival time of a received packet is measured at 90% of peak amplitude of a received signal, 90% of peak power of a received signal, 90% of total power of a received signal, or a mean delay of a received signal.
Claim 26	
[26]	The computer program product of claim 21, wherein the first node is a network coordinator.
Claim 27	
[27]	The computer program product of claim 21, wherein the second node is a new node and the functions are performed as part of admission of the second node to the communication network.
Claim 28	
[28]	The computer program product of claim 21, wherein the functions of exchanging local clock times, performing the ranging method, and adjusting the local clock times are performed periodically to maintain synchronization between the first and second nodes.
Claim 29	
[29]	The computer program product of claim 21, wherein the communication network is a mesh network.

Claim 30	
[30]	The computer program product of claim 21, wherein the communication network operates in accordance with a Multimedia over Coax Alliance (MoCA) standard.
Claim 31	
[31.pre]	A network interface module, comprising:
[31.a]	a controller;
[31.b]	memory coupled to the controller;
[31.c]	computer executable program code on a non-transitory computer readable medium configured to cause the controller to perform the functions of:
[31.d]	exchanging local clock times between a first node and a second node over a network, wherein the exchange comprises:
[31.d.i]	transmitting a first packet from the first node to the second node, wherein the first packet includes a first packet clock time set to the local clock time of the first node at transmission time, and includes a scheduled arrival clock time, and
[31.d.ii]	setting the local clock time of the second node to the first packet clock time;

[31.e]	performing a ranging method between the first and second nodes based on the local clock times exchanged between the first and second nodes, wherein the ranging method results in an estimated propagation delay between the first and second nodes, and wherein the ranging method comprises:
[31.e.i]	transmitting a second packet from the second node to the first node, wherein the second packet is transmitted from the second node at the scheduled arrival clock time, and wherein the second packet is received by the first node at an actual arrival clock time,
[31.e.ii]	calculating and storing the estimated propagation delay at the first node, wherein calculating the estimated propagation delay is based on the scheduled arrival clock time and the actual arrival time, and
[31.e.iii]	transmitting a third packet from the first node to the second node, wherein the third packet comprises the estimated propagation delay; and
[31.f]	adjusting the local clock times of either the first and second nodes based on the estimated propagation delay, thereby resulting in a synchronized local clock time at the first and second nodes.
Claim 32	

[32]	The network interface module of claim 31, wherein the computer executable program code is further configured to cause the controller to use the synchronized local clock time in subsequent packet transmissions between the first and second nodes.
Claim 33	
[33]	The network interface module of claim 31, wherein adjusting the local clock times comprises storing the estimated propagation delay the second node.
Claim 34	
[34]	The network interface module of claim 31, wherein a transmission time of a transmitted packet is measured at 90% of peak amplitude of a transmission signal, 90% of peak power of a transmission signal, 90% of total power of a transmission signal, or a mean delay of a transmission signal.
Claim 35	
[35]	The network interface module of claim 31, wherein an arrival time of a received packet is measured at 90% of peak amplitude of a received signal, 90% of peak power of a received signal, 90% of total power of a received signal, or a mean delay of a received signal.

Claim 36	
[36]	The network interface module of claim 31, wherein the first node is a network coordinator.
Claim 37	
[37]	The network interface module of claim 31, wherein the second node is a new node and the functions are performed as part of admission of the second node to the communication network.
Claim 38	
[38]	The network interface module of claim 31, wherein the functions of exchanging local clock times, performing the ranging method, and adjusting the local clock times are performed periodically to maintain synchronization between the first and second nodes.
Claim 39	
[39]	The network interface module of claim 31, wherein the communication network is a mesh network.
Claim 40	
[40]	The network interface module of claim 31, wherein the communication network operates in accordance with a Multimedia over Coax Alliance (MoCA) standard.

I. INTRODUCTION

DISH Network L.L.C., DISH Network Service L.L.C., DISH Network Corporation, and DISH Network California Service Corporation, (collectively, "Petitioner" or "DISH") petition for *Inter Partes* Review ("IPR") under 35 U.S.C. §§311-319 and 37 C.F.R. §42 of claims 1-40 (the "Challenged Claims") of U.S. Patent No. 8,363,681 (the "'681 Patent").

The '681 Patent's claims relate to a back-and-forth ranging procedure to synchronize the local clocks of multiple network nodes. This procedure was well-understood and obvious before the '681 Patent's earliest potential priority date, as evidenced by IEEE802.3ah (DISH-1005) and Frei (DISH-1007).

Ground 1 relies on IEEE802.3ah, which teaches a back-and-forth ranging procedure that synchronizes the local clocks of multiple network nodes by calculating a packet's round-trip time ("RTT") between them. IEEE802.3ah further teaches that its RTT consists of an upstream and a downstream propagation delay (the time to get from one node to another). Ground 2 combines IEEE802.3ah with Frei, which teaches techniques for deriving propagation delay from RTT and using propagation delay to synchronize the local clocks of nodes. The remaining Grounds demonstrate that the '681 Patent's additional claims were obvious. Institution of this IPR under 35 U.S.C. §§311-19 and 37 C.F.R. §42 is thus warranted.

II. REQUIREMENTS FOR IPR—37 C.F.R. §42.104

A. Grounds for Standing—37 C.F.R. §42.104(a)

Petitioner certifies that the ’681 Patent is available for IPR and Petitioner is not barred or estopped from requesting this review. The present Petition is filed within one year of service of a complaint against DISH in 2:23-CV-01043 (C.D. Cal.). DISH-1021; DISH-1022.

B. Challenge and Relief Requested—37 C.F.R. §42.104(b)

This Petition demonstrates a reasonable likelihood of prevailing as to at least one Challenged Claim. Petitioner requests institution of IPR and cancellation of all Challenged Claims based on the grounds identified below. The expert declaration of Dr. Scott Acton (DISH-1003, ¶¶1-459) provides complementary support.

Ground	Patent Claims	35 U.S.C. §103 Basis
1A / 1B	**1-3, 6-10** **11-13, 16-23, 26-33, 36-40**	IEEE802.3ah / IEEE802.3ah-Shvodian
2A / 2B	**1-3, 6-10** **11-13, 16-23, 26-33, 36-40**	IEEE802.3ah-Frei / IEEE802.3ah-Shvodian-Frei
3A / 3B	**9-10** **19-20, 29-30, 39-40**	IEEE802.3ah-Frei-Ovadia / IEEE802.3ah-Shvodian-Frei-Ovadia

Ground	Patent Claims	35 U.S.C. §103 Basis
4A / 4B	**4-5** **14-15, 24-25, 34-35**	IEEE802.3ah-Frei-Smith / IEEE802.3ah-Shvodian-Frei-Smith

Each reference pre-dates 2008-10-16, which is the earliest possible priority date from which the ’681 Patent can claim priority.[1]

Reference	Prior Art Date (at least as early as)	Basis (at least under)
IEEE802.3ah (DISH-1005)	Published 2004-09-07[2]	§102(b)
Shvodian (DISH-1006)	Published 2008-05-01[3]	§102(a)
Frei (DISH-1007)	Published 2007-06-21[4]	§102(b)
Ovadia (DISH-1008)	Published 2007-10-10[5]	§102(b)

1 Petitioner does not concede that the ’681 Patent is entitled to the earliest possible priority date.

2 DISH-1005, Abstract; DISH-1010, ¶¶6-17.

3 DISH-1006, Cover.

4 DISH-1007, Cover.

5 DISH-1008, Cover; DISH-1010, ¶¶18-29.

Reference	Prior Art Date (at least as early as)	Basis (at least under)
Smith (DISH-1009)	Filed 2007-12-21[6]	§102(e)

C. Claim Construction—37 C.F.R. §42.104(b)(3)

Because the Challenged Claims are obvious under any reasonable interpretation, no express constructions are required here. *See Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011). Petitioner reserves the right to address constructions proposed by Patent Owner or the Board and pursue constructions in district court necessary to decide matters of infringement and validity under 35 U.S.C. §112 exceeding the scope of an *inter partes* review. 35 U.S.C. §311(b). Petitioner does not concede that the Challenged Claims satisfy statutory requirements.

III. THE ’681 PATENT

A. Summary

The ’681 Patent relates to “using ranging to improve network efficiency.” DISH-1001, Abstract. The Challenged Claims recite substantially the same ranging procedure: Nodes synchronize their internal clocks by exchanging messages and estimating delay. *Id.*, 14:17-18:47.

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6 DISH-1009, Cover.

As the patent acknowledges, the Multimedia over Coax Alliance (MoCA) 1.0 technical standard was released prior to the '681 Patent and defined a "protocol for distributing digital entertainment over … coaxial cable previously installed in households." *Id.*, 1:34-40, 1:62-66. MoCA 1.0 contemplated a preexisting tree-and-branch structure including multiple nodes (e.g., TVs) communicating. *Id.*, 2:14-43. An example of such a network is below.

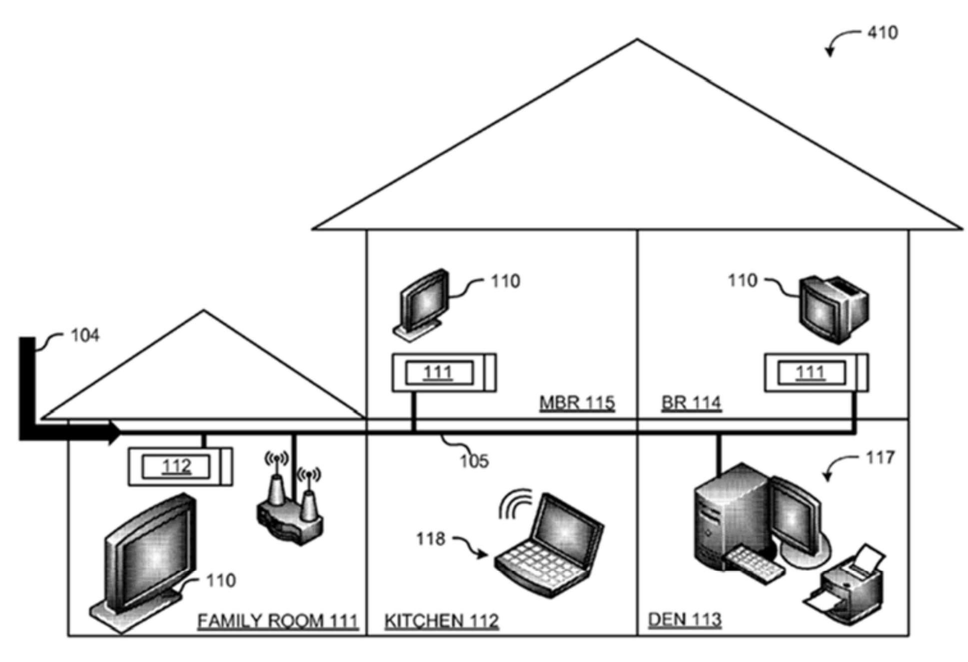

FIG. 1
(PRIOR ART)

'681 Patent Fig. 1

The patent explains that "network architects ha[d] come up with various solutions to arbitrate disputes or otherwise allocate bandwidth among the various

communicated devices, or clients, on the network." *Id.*, 2:4-13. One solution was designating a "network coordinator" node that "schedule[d] all traffic on the network." *Id.*, 2:37-39. Doing this ensured that nodes sent messages at separate times, "avoiding packet collisions." *Id.*

The patent describes that, for scheduling to be effective, it was known that each node must have a synchronized local clock; otherwise, nodes might inadvertently send messages that collide. *Id.*, 2:44-59. Without proper synchronization, the network would need extra time between messages—slower communication—to prevent collisions. *Id.*, 3:15-49, 3:48-49.

The patent admits that prior standards had addressed synchronizing nodes' local clocks. For example, the preexisting "MoCA 1.x specification" included a "[local channel time clock] synchronization process between" nodes. *Id.*, 2:44-59; 2:60-3:14. This is depicted in Figure 2.

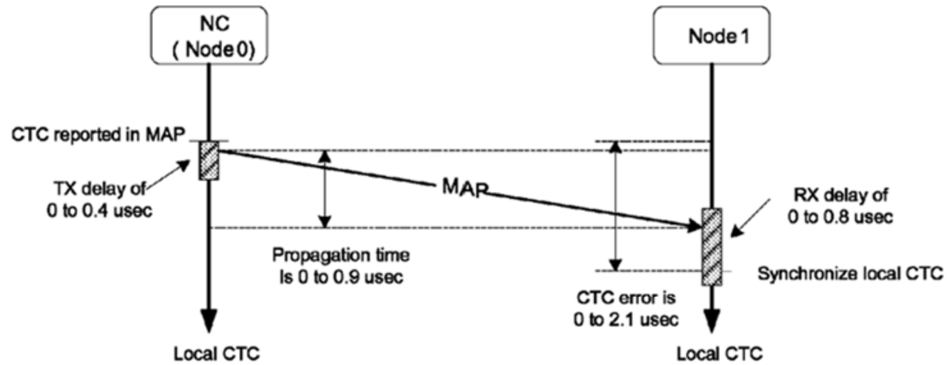

FIG. 2
(Prior Art)

'681 Patent Fig. 2

To allegedly improve synchronization, the patent describes a ranging technique that purports to "more accurately control[] the expected start and end times for arriving network packets." *Id.*, 3:54-65. Unlike the one-directional synchronization of MoCA 1.x (one message from NC to Node 1), the patent discloses sending messages ***back-and-forth*** between two nodes. DISH-1003, ¶¶21-27.

The patent's procedure estimates the "propagation delay" between two nodes and then adjusts the local clock time based on that estimated propagation delay. DISH-1001, 4:20-34. It depicts the claimed ranging procedure in Figures 5 and 9

(below). Notably, the claims do not require implementation in a coaxial network. DISH-1003, ¶28.

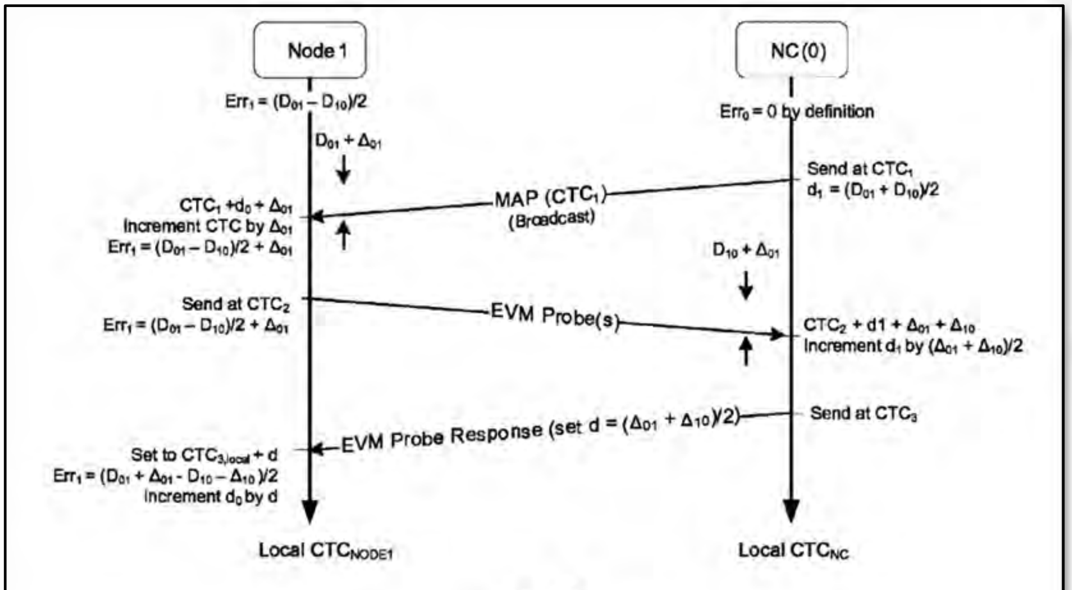

FIG. 9

B. Prosecution History

The Examiner issued a first office action rejecting multiple claims on prior art grounds and indicating that certain dependent claims included allowable subject matter. DISH-1002, 74-84. The applicant then amended the rejected independent claims to purportedly incorporate some limitations from the allowable subject matter. *Id.*, 50-51, 62-64. For example, the independent claims were amended to include at least the following limitations:

- "transmitting a first packet from the first node to the second node, wherein the first packet includes a first packet clock time set to the local clock time of the first node at transmission time, and includes a scheduled arrival clock time, and";

- "setting the local clock time of the second node to the first packet clock time;";
- "transmitting a second packet from the second node to the first node, wherein the second packet is transmitted from the second node at the scheduled arrival clock time, and wherein the second packet is received by the first node at an actual arrival clock time,";
- "calculating and storing the estimated propagation delay at the first node, wherein calculating the estimated propagation delay is based on the scheduled arrival clock time and the actual arrival time, and";
- "transmitting a third packet from the first node to the second node, wherein the third packet comprises the estimated propagation delay".

Id., 51-61. The Examiner allowed the amended claims and did not include a Statement of Reasons for Allowance. *Id.*, 30; DISH-1003, ¶¶30-34.

C. Level of Ordinary Skill in the Art

For this IPR, a person of ordinary skill in the art ("POSITA") would have had a Bachelor's degree in electrical engineering, computer engineering, computer science, or a related field, and 2-3 years of experience in design or development of communication systems/networks including cable communication systems, or the equivalent. Additional education could substitute for experience, or experience in the field could substitute for formal education. DISH-1003, ¶¶1-11, 16-17.

IV. THE CHALLENGED CLAIMS ARE UNPATENTABLE

Each Challenged Claim recites subject matter rendered obvious by references predating the '681 Patent.

IEEE802.3ah provided blueprints for coordinating network node clocks.[7] Like other networking protocols of the time, it included multiple features ensuring network nodes communicated efficiently. The ’681 Patent concedes this, explaining that network architects had already “come up with various solutions” to increase network efficiency. DISH-1001, 2:4-13.

One such solution, implemented by IEEE802.3ah, was the technique of back-and-forth “ranging.” DISH-1005, 4; DISH-1003, ¶¶35-39. Dating back to the 1970s, ranging is a process whereby network nodes send messages back-and-forth to measure the time it takes for a message to travel between them and, subsequently, to estimate the propagation delay between them. DISH-1003, ¶37 (citing DISH-1011; DISH-1012). Nodes use this to synchronize their local clocks: If a recipient node knows the time a message was sent and how long it took to arrive (i.e., the propagation delay), the recipient can use that information to set its clock to be the same as the sender’s. *Id.*; DISH-1005, 4.

Like IEEE802.3ah, Frei’s network protocol implemented a back-and-forth ranging procedure. Frei explicitly calculates propagation delay and sends that value to other nodes for synchronizing their clocks.

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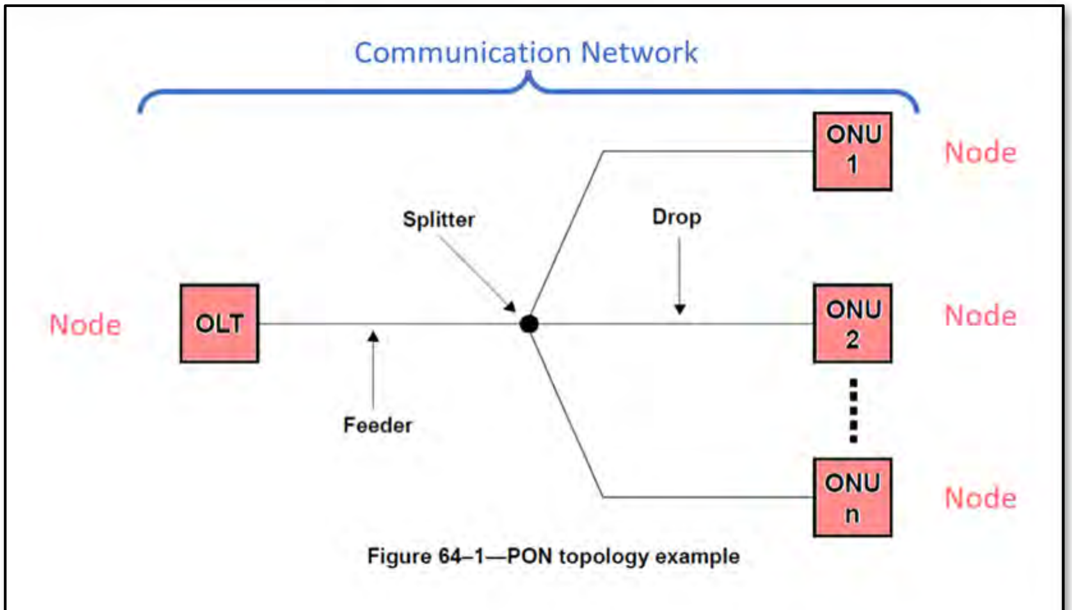
[7] No independent Challenged Claim recites a coaxial and/or wired network.

IEEE802.3ah, individually and with other protocols like Frei, renders obvious the ranging protocol recited by each of the Challenged Claims. DISH-1003, ¶¶35-39.

A. Ground 1A: Claims 1-3, 6-10 Are Rendered Obvious by IEEE802.3ah

1. Overview of IEEE802.3ah

IEEE802.3ah "introduce[d] the concept of Ethernet Passive Optical Networks," which implement "a point to multipoint (P2MP) network topology" in "optical fiber." DISH-1005, 179. This point-to-multipoint implementation allowed nodes in a tree-and-branch structure to communicate individually with each other. *Id.*, 421; DISH-1003, ¶¶40-53. Below is an IEEE802.3ah structure including OLT and ONU nodes.



IEEE802.3ah Fig. 64-1 (annotated)

IEEE802.3ah's network is designed to avoid packet collisions (e.g., when ONU_1 and ONU_2 send packets that potentially arrive at the splitter at the same time, thereby colliding). DISH-1003, ¶¶41-47. "To avoid data collisions and increase the efficiency …, ONU's transmissions are arbitrated." DISH-1005, 421. "The network operates by allowing only a single ONU to transmit in the upstream direction at a time," with the OLT "responsible for timing the different transmissions." DISH-1005, 422.

For OLT's timing instructions to succeed, the OLT and ONU nodes' clocks must be synchronized. DISH-1003, ¶¶41-47. IEEE802.3ah achieved synchronization by performing "Ranging," defined as "[a] procedure by which the propagation delay between a master (e.g., OLT) and slave (e.g., ONU) is measured." DISH-1005, 4. IEEE802.3ah performs ranging for all "discovered devices for improved network performance" to ensure "[c]ontinuous ranging for compensating round trip time [RTT] variation." *Id.*, 422.

IEEE802.3ah's ranging involves sending messages back-and-forth between two nodes. DISH-1003, ¶48. ***First***, the OLT sends a GATE message to an ONU including both (i) a timestamp for OLT's local time and (ii) the start_time, at which the ONU should respond. DISH-1005, 4 (using a timestamp "to synchronize slaves (e.g., ONUs) with the master (OLT) and for the ranging process"); *id.*, 455 ("An ONU will begin transmission when its localTime counter matches start_time value

indicated in the GATE message."); DISH-1003, ¶48. ***Second***, the ONU "sets its counter according to the value in the timestamp field in the received" GATE message. DISH-1005, 427; DISH-1003, ¶48. ***Third***, when the ONU's local time equals the received "start_time," the ONU responds with a message including the time the response is sent. DISH-1005, 455; DISH-1003, ¶48. ***Fourth***, the OLT receives the message and uses it to calculate the "round trip delay [RTT]"—which comprises the "propagation delay"—"using the timestamp ... from the ONU." DISH-1005, 4 (defining "ranging"); DISH-1003, ¶48. ***Finally***, the RTT (including propagation delay) is used to adjust at least one of the local nodes' clocks. *See* DISH-1005, 427 (explaining that the "client can use this RTT for the ranging process"); DISH-1003, ¶48.

IEEE802.3ah details the ranging process and depicts an implementation in Figure 64-4. DISH-1003, ¶¶49-50. This figure shows the message sent from OLT to ONU, the reply sent by ONU, the times those messages are sent, and some information in those messages. The figure also describes calculation of RTT and propagation delay.

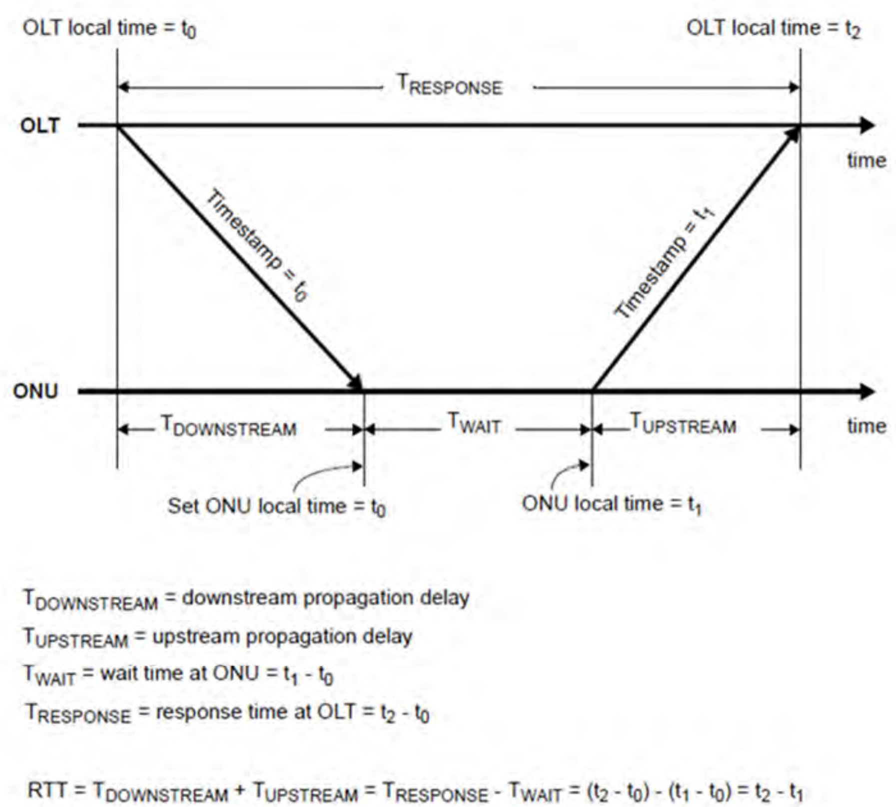


Figure 64–4—Round trip time calculation

IEEE802.3ah Fig. 64-4

2. IEEE802.3ah Is Analogous Art

IEEE802.3ah is analogous art to the patent both because it "is from the same field of endeavor," and because it is "reasonably pertinent to the particular problem with which the inventor … [wa]s involved." *See Donner Tech., LLC v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1359 (Fed. Cir. 2020); DISH-1003, ¶¶51-53.

First, the patent and IEEE802.3ah are from the same field. DISH-1003, ¶¶51-53. Under "Field of Disclosure," the patent describes that "[t]he present disclosure

relates to networks, and more particularly, some embodiments relate to using range estimates to improve efficiency in networks, particularly networking over coaxial cable." DISH-1001, 1:15-19. IEEE802.3ah relates to networks, uses range estimates to improve efficiency, addresses node synchronization, and is intended for implementation in wired networks. DISH-1005, v, 4; DISH-1003, ¶¶51-53.

Second, IEEE802.3ah's disclosure of ranging to synchronize node clocks is "reasonably pertinent to the particular problem" of the patent. *Donner*, 979 F.3d at 1359; DISH-1003, ¶¶51-53. The patent and IEEE802.3ah address the same problem (synchronizing nodes' clocks to increase network efficiency by avoiding packet collisions) using the same technique (back-and-forth ranging). *Id*. A POSITA therefore would have understood IEEE802.3ah to be analogous. *Id*.

3. Claim 1

[1.pre] "A method for synchronizing a plurality of nodes on a communication network, comprising:"

To the extent the preamble is limiting, IEEE802.3ah discloses [1.pre]. DISH-1003, ¶¶54-58. IEEE802.3ah discloses a communication network comprising multiple nodes. DISH-1005, Fig.64-1; DISH-1003, ¶¶54-58. Figure 64-1 discloses a communication network with OLT and ONU nodes.[8]

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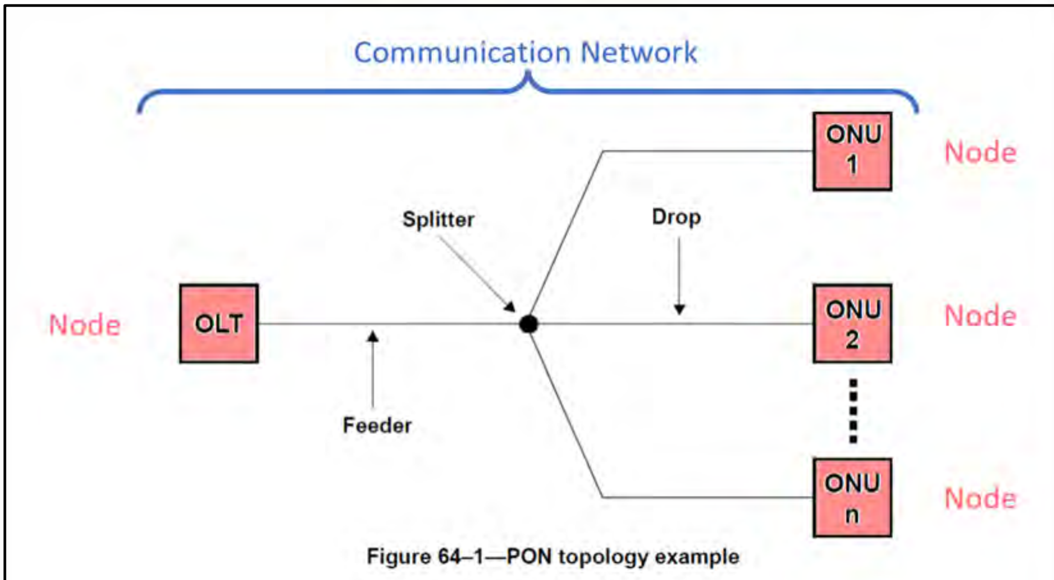
[8] Annotations and emphasis added unless otherwise noted.



IEEE802.3ah Fig. 64-1 (annotated)

These nodes communicate with each other. *Id.*, 421 ("Topics dealt with in this clause include allocation of upstream transmission resources to different ONUs, discovery and registration of ONUs into the network …."); *id.*, Cover ("Telecommunications and information exchange between systems—Local and metropolitan area networks"). A POSITA would have understood that IEEE802.3ah's teachings apply to multi-node communication networks. DISH-1003, ¶¶54-58.

IEEE802.3ah teaches that its nodes "synchroniz[e]." DISH-1003, ¶¶54-58. For example, "[n]ew devices are discovered in the network and allowed transmission through the Discovery Processing function," which includes synchronizing the nodes' clocks using ranging. DISH-1005, 439; *see* DISH-1005, 427 (describing the

ranging process begins "[w]hen either device [OLT or ONU] transmits an MPCPDU"); DISH-1003, ¶¶54-58. IEEE802.3ah explains that ranging is a "procedure by which the propagation delay between master (e.g., OLT) and slave (e.g., ONU) is measured," and is "used to synchronize slaves … with the master (OLT)." DISH-1005, 4. The synchronization process is depicted in Figure 64-4.

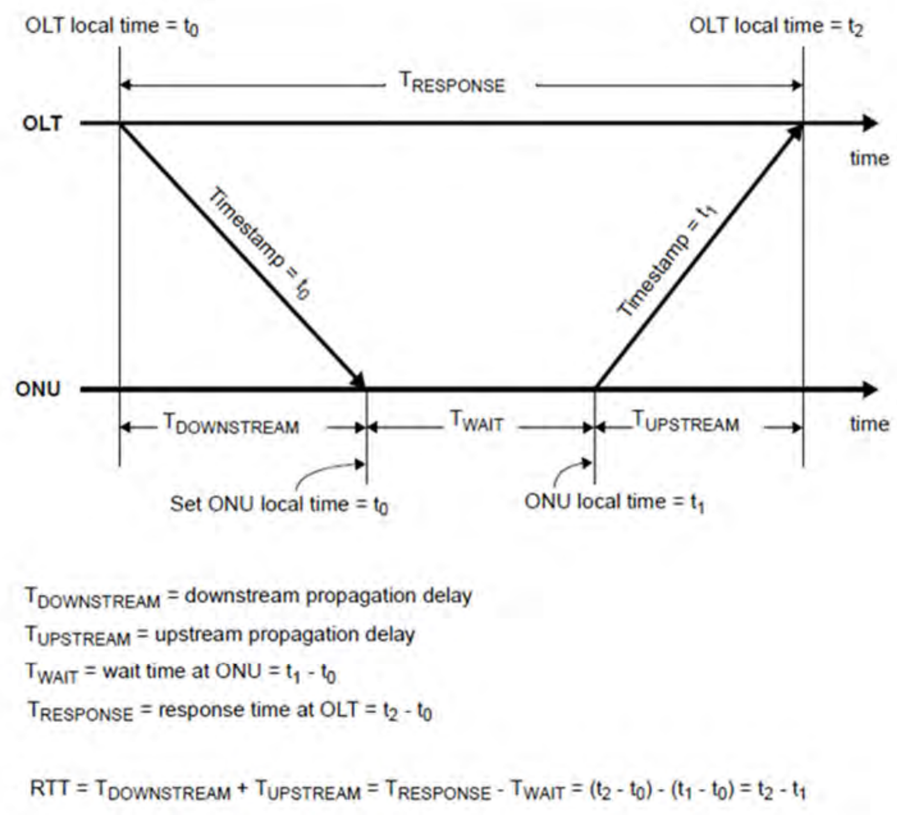


Figure 64–4—Round trip time calculation

IEEE802.3ah Fig. 64-4

[1.a] "exchanging a local clock time between a first node and a second node over the communication network, wherein the exchange comprises:"

IEEE802.3ah discloses [1.a]. DISH-1003, ¶¶59-63. For example, IEEE802.3ah discloses that an OLT node will send a GATE message to an ONU node including the OLT's "local clock stamp" (i.e., "a first packet clock time set to the local clock time of the first node at transmission time") during the "Ranging and Timing Process." DISH-1005, 427-28 (explaining that the node "provide[s] a local time stamp" during ranging); DISH-1003, ¶¶59-63. Specifically, when any node "transmits an MPCPDU [Multi-Point Control Protocol Data Unit, in this instance, the GATE message], it maps its counter value into the timestamp field. The time of transmission ... is taken as the reference time used for setting the timestamp value." DISH-1005, 427. Figure 64-4 depicts this local clock time exchange, showing that the OLT node sends a message to the ONU node including the OLT's local transmission time (depicted in Fig.64-4 as t_0).

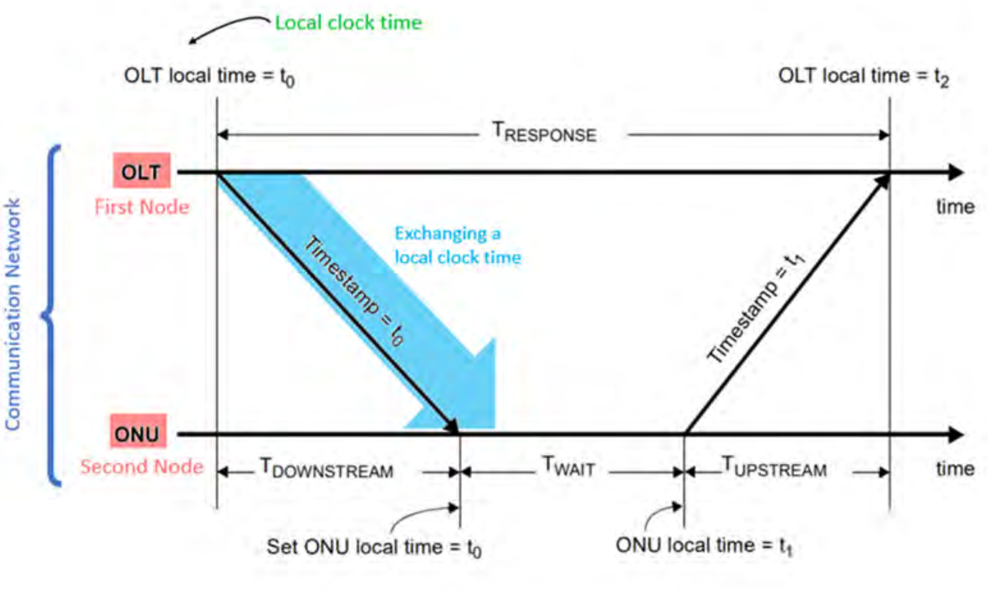


Figure 64–4—Round trip time calculation

IEEE802.3ah Fig. 64-4 (annotated)

See DISH-1003, ¶¶59-63.

[1.a.i] "transmitting a first packet from the first node to the second node, wherein the first packet includes a first packet clock time set to the local clock time of the first node at transmission time, and includes a scheduled arrival clock time, and"

As discussed in [1.a], IEEE802.3ah discloses exchanging a local clock time between first node second nodes. DISH-1003, ¶¶64-72. The details of this process disclose [1.a.i]. DISH-1003, ¶¶64-72.

To learn an ONU node, IEEE802.3ah teaches that the OLT node sends a "GATE message." DISH-1005, 464. This message includes (i) OLT's local

transmission time and (ii) the scheduled response time for ONU. *Id.*; DISH-1003, ¶¶64-72.

Regarding the claimed "set to the local clock time" portion, IEEE802.3ah teaches that "GATE MPCPDU is an instantiation of the Generic MPCPDU," (DISH-1005, 464)—discussed in [1.a]—and it therefore includes the OLT's local time when the message was sent—also discussed in [1.a]. *Id.*, 465; DISH-1003, ¶¶64-72. This is depicted by "Timestamp" in Figure 64-31. DISH-1003, ¶¶64-72.

Regarding the claimed "scheduled arrival clock time" portion, IEEE802.3ah discloses that "[t]he purpose of GATE message is to grant transmission windows to ONUs for both discovery messages and normal transmission." DISH-1005, 464; DISH-1003, ¶¶64-72. To do this, the GATE message includes a Grant Start Time (i.e., the "scheduled arrival clock time") in each GATE message that schedules when the ONU node must respond. DISH-1005, 464-65 (depicting Grant Start Time fields in Figure 64-31). "An ONU will begin transmission ***when its localTime counter matches start_time value*** indicated in the GATE message." *Id.*, 455.[9] As shown in [1.a.ii], ONU will first set its local clock to be the time of transmission of the first

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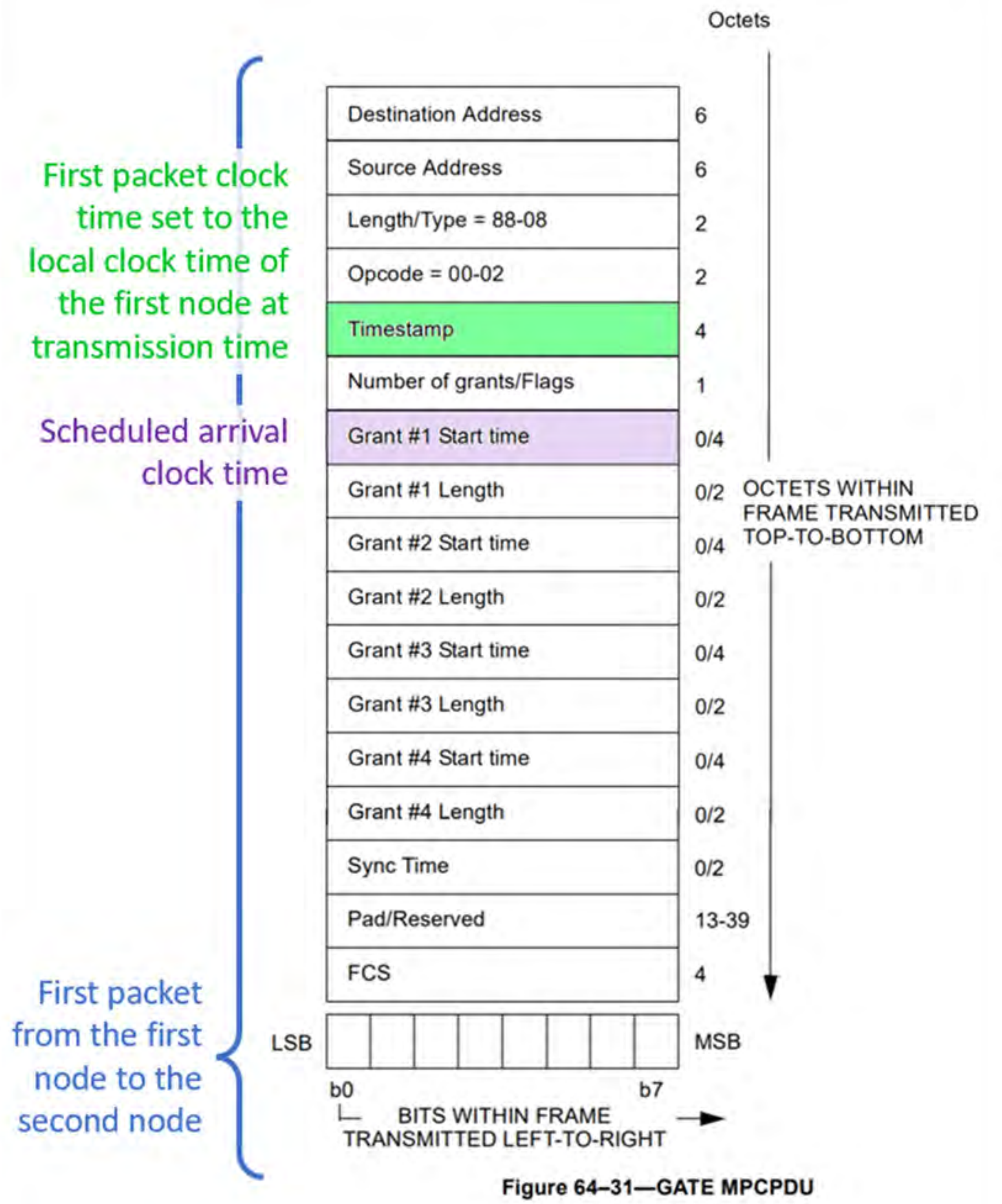
[9] Any Grant Start Time included in a GATE message satisfies this limitation because each triggers the ONU to respond; therefore, each is a "scheduled arrival clock time." DISH-1003, ¶68.

packet. Afterward, ONU will begin transmission when its localTime counter matches the start_time value in the GATE message.

Figure 64-31 shows the GATE message's contents. *See* DISH-1003, ¶¶64-72.



IEEE802.3ah Fig. 64-31 (annotated)

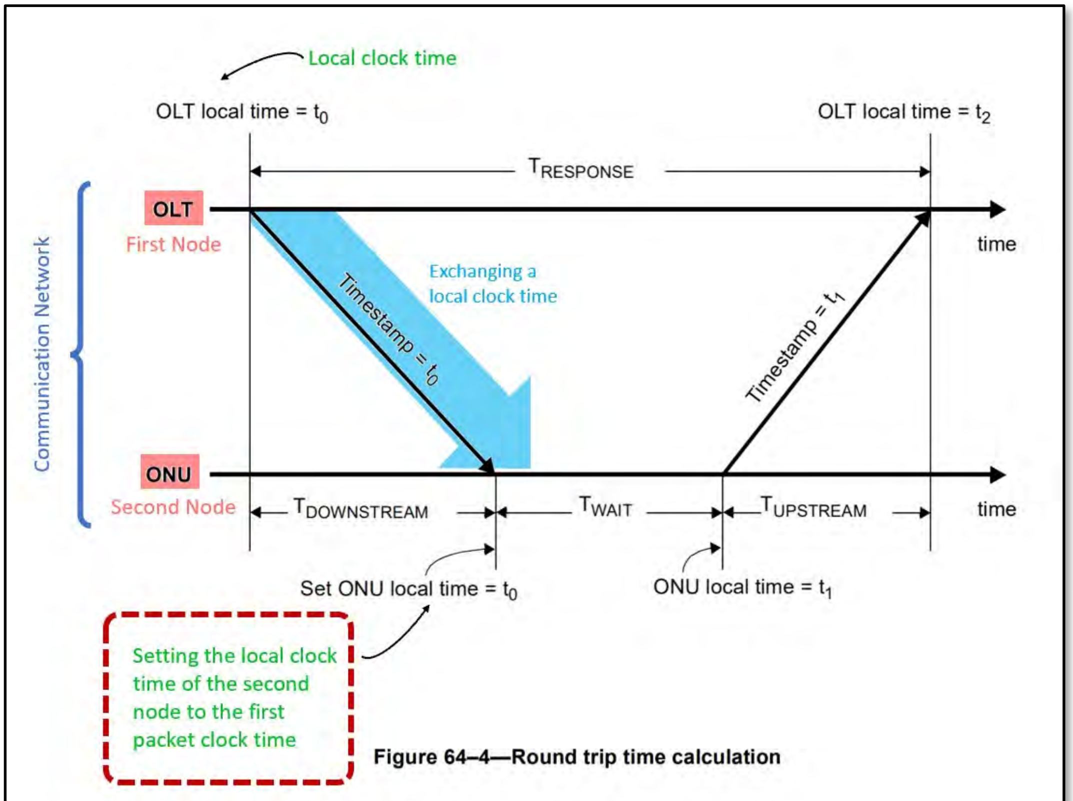
A POSITA would have understood that IEEE802.3ah's GATE message is a "first packet" according to the patent. *Id*. The patent defines "packet" broadly, explaining it can be "one of several different packet types" including, "data packets,

control packets, and probe packets." DISH-1001, 6:48-63; DISH-1003, ¶¶64-72. For example, the patent describes that a node may "communicate[] the schedule to each client node in 'Media Access Packets' (MAPs), where each MAP is a packet of information." *Id.*, 2:39-43. Similarly, the GATE message of IEEE802.3ah is a protocol data unit (PDU), including a header and a payload, that is sent at the Media Access Control ("MAC") level; therefore it is a data packet as described by the patent. DISH-1005, 463; DISH-1003, ¶¶64-72. A POSITA would have known that any GATE or MPCPDU message qualifies as the claimed "packet."

[1.a.ii] "setting the local clock time of the second node to the first packet clock time;"

IEEE802.3ah discloses [1.a.ii]. DISH-1003, ¶¶73-77. IEEE802.3ah discloses that "[w]hen the ONU receives MPCPDUs, it sets its counter according to the value in the timestamp field in the received MPCPDU." DISH-1005, 427. As discussed

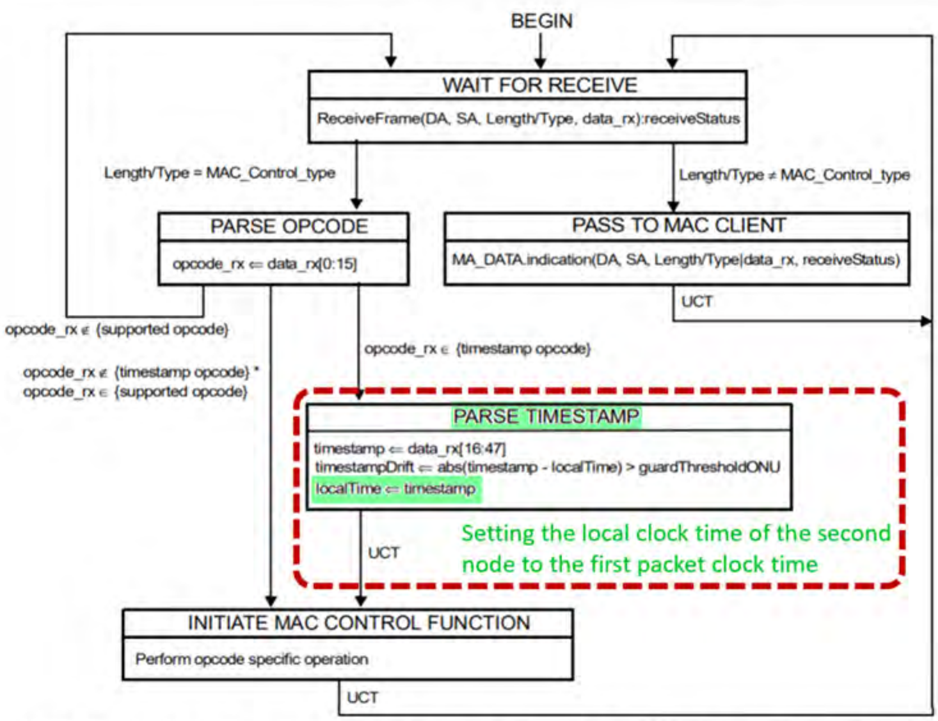
above, the timestamp field contains OLT's clock time at the time of transmission. DISH-1003, ¶¶73-77. Figure 64-4 (below) shows this.



IEEE802.3ah Fig. 64-4 (annotated)

Further, IEEE802.3ah's Figure 64-11 (below) teaches setting of the OLT's clock time because, upon receipt of the OLT message, the ONU node "parse[s] [the] timestamp" in the message by setting the ONU node's local time equal to the

received timestamp. DISH-1005, Fig.64-11 ("localTime <= timestamp"); DISH-1003, ¶¶73-77.



NOTE– The opcode-specific operation is launched as a parallel process by the MAC Control sublayer, and not as a synchronous function. Progress of the generic MAC Control Receive state machine (as shown in this figure) is not implicitly impeded by the launching of the opcode specific function.

Refer to Annex 31A for list of supported opcodes and timestamp opcodes.

Figure 64–11—ONU Control Parser state diagram

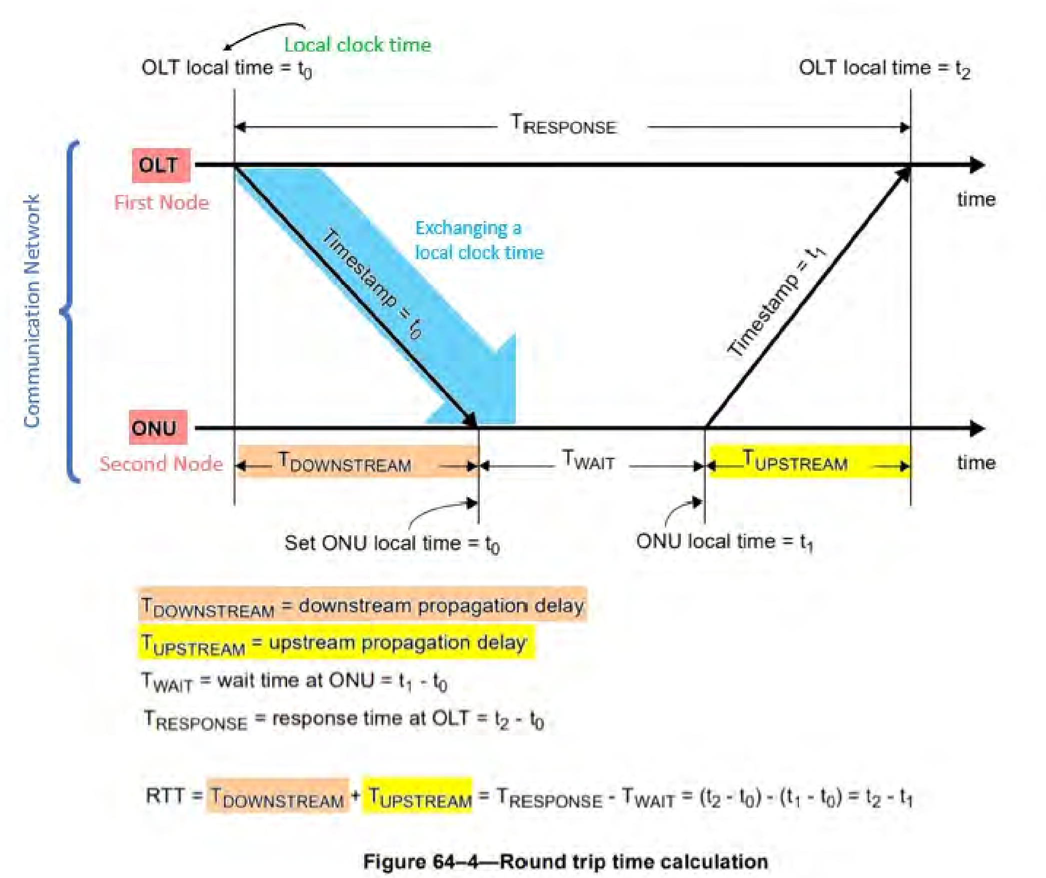
IEEE802.3ah Fig. 64-11 (annotated)

[1.b] "performing a ranging method between the first and second nodes based on the local clock time exchanged, wherein the ranging method results in an estimated propagation delay between the first and second node, and wherein the ranging method comprises:"

IEEE802.3ah discloses or renders obvious [1.b]. DISH-1003, ¶¶78-84.

Regarding the claimed "performing a ranging method" portion, IEEE802.3ah teaches the use of "Ranging: A procedure by which the propagation delay between

a master (e.g., OLT) and slave (e.g., ONU) is measured. The round trip delay [RTT] computation is performed by the OLT, using the timestamp in MPCP messages from the ONU." DISH-1005, 4. The RTT is "equal to the difference between the timer value [the first node's clock time when it receives from the second node] and the value in the timestamp field [the time the second node was scheduled to respond]." *Id.*, 427; DISH-1003, ¶¶78-84. Notably, the value in the timestamp field and, thus, the "ranging method between the first and second nodes," is "based on the local timestamp exchanged" in the first packet as explained in [1.a.i]. Accordingly, IEEE802.3ah bases the ranging method on the local clock time exchanged between the OLT and the ONU. This is shown in Figure 64-4 (below).



IEEE802.3ah Fig. 64-4 (annotated)

Regarding the claimed "estimated propagation delay" portion, Figure 64-4 teaches that the ranging method results in RTT. DISH-1005, Fig.64-4. It further teaches that RTT is the sum of downstream propagation delay (time from node 1 to 2, Fig.64-4's $T_{DOWNSTREAM}$) and upstream propagation delay (time from node 2 to 1, Fig.64-4's $T_{UPSTREAM}$). *Id.*; DISH-1003, ¶¶78-84. A POSITA would have understood that IEEE802.3ah's ranging method includes calculations of an estimated propagation delay because the downstream propagation delay and the

upstream propagation delay are included in RTT. *Id.*, 4; DISH-1003, ¶¶78-84. Thus, a POSITA would have understood IEEE802.3ah's ranging method to result in "an estimated propagation delay" (i.e., $T_{UPSTREAM}$ and $T_{DOWNSTREAM}$). DISH-1003, ¶¶78-84.

A POSITA would have understood that IEEE802.3ah's ranging method "results in an estimated propagation delay" based on the logic of the ranging procedure. DISH-1003, ¶82. In [1.a.ii], the ONU set its clock to the timestamp received in the first GATE message. *Id.* That timestamp contained the time the OLT node sent the GATE message. *Id.* Because the message took ***n*** seconds to travel from the OLT to the ONU node, the ONU node's clock will be ***n*** seconds later than the OLT's clock. *Id.* Accordingly, a POSITA would have found it logical and obvious to synchronize OLT and ONU's clocks by adjusting ONU's clock by ***n*** (the time to travel from OLT to ONU i.e., the downstream propagation delay). *Id.* The logic of IEEE802.3ah's ranging protocol dictates that propagation delay, not RTT, would be used. *Id.*

A POSITA also would have found it obvious to implement a method resulting in "estimated propagation delay" in IEEE802.3ah. DISH-1003, ¶¶78-84. A POSITA would have understood that IEEE802.3ah at least suggests the use of an "estimated propagation delay" in its ranging method based on its RTT calculation including these characteristics. Further, a POSITA would have understood that

implementing such a method would allow the system to adjust the local clock by precisely the amount of time that the OLT and ONU's clocks differ. DISH-1003, ¶¶78-84. A POSITA would have had a reasonable expectation of success in implementing a "ranging method [that] results in an estimated propagation delay" in IEEE802.3ah because a POSITA would have understood such a "ranging method" was already calculated by IEEE802.3ah. *Id*.

[1.b.i] "transmitting a second packet from the second node to the first node, wherein the second packet is transmitted from the second node at the scheduled arrival clock time, and wherein the second packet is received by the first node at an actual arrival clock time,"

IEEE802.3ah discloses or renders obvious [1.b.i]. DISH-1003, ¶¶85-93. As discussed above, IEEE802.3ah teaches a network node synchronization procedure relying on ranging that is initiated when an OLT node sends a GATE message to an ONU node. *Id*. The GATE message includes information about when the ONU node is instructed to respond, i.e., the "scheduled arrival clock time." DISH-1005, 4 (explaining the GATE message instructs ONU "to transmit at a specific time"); DISH-1003, ¶¶85-93. The "ONU will begin transmission when its localTime

counter matches start_time value indicated in the GATE message."[10] *Id.*, 455. Like all messages from ONUs, this message is transmitted to OLT. *Id.*, 421 ("[T]he signal transmitted by an ONU would only reach the OLT, but not other ONUs."). Accordingly, ONU is instructed to transmit a responsive packet (the second packet from the second node) to the first node at the grant "start_time" (the scheduled arrival clock time). DISH-1003, ¶¶85-93.

That start_time is included in the responsive packet sent by the second node as its timestamp. The ONU sends MPCPDU messages as part of ranging. DISH-1005, 427 (describing that "OLT receives MPCPDU" from ONUs during ranging). When a node "transmits an MPCPDU, it maps its counter value into the timestamp field." DISH-1005, 427. Because the responsive packet was sent at the start_time communicated via the GATE message, the responsive packet will include the start_time in its time-of-sending timestamp. DISH-1005, 427; DISH-1003, ¶¶85-93.

Figure 64-4 depicts the second packet being sent from the ONU to the OLT, showing the second packet being sent at the scheduled arrival clock time (t_1) and

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[10] For example, ONU sends unicast channel messages during the discovery handshake when its local clock is equal to the grant start time. DISH-1005, Figs.64-14, 64-29; DISH-1003, ¶86.

arriving at the actual arrival clock time (t_2). A POSITA would have understood that t_2 is the claimed "actual arrival clock time" because it is the first node's clock time when the second message arrives. DISH-1003, ¶¶85-93.

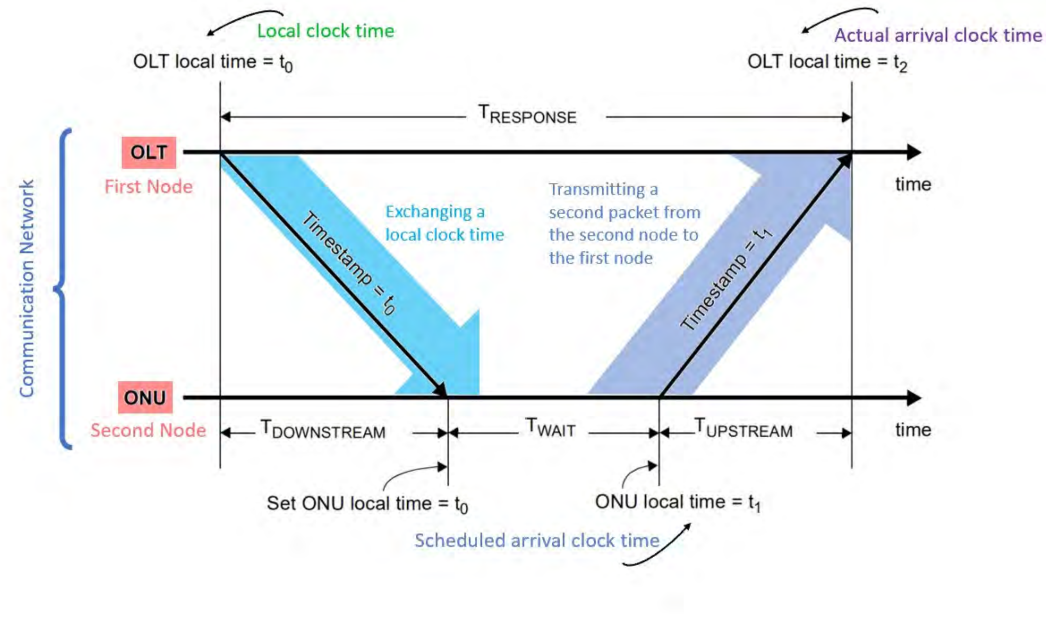

Figure 64–4—Round trip time calculation

IEEE802.3ah Fig. 64-4 (annotated)

[1.b.ii] "calculating and storing the estimated propagation delay at the first node, wherein calculating the estimated propagation delay is based on the scheduled arrival clock time and the actual arrival time, and"

IEEE802.3ah renders obvious [1.b.ii]. DISH-1003, ¶¶94-104. As discussed in [1.b], IEEE802.3ah teaches ranging to measure RTT and, included therein, propagation delay. DISH-1003, ¶¶94-104. As discussed in [1.b], calculating and using propagation delay would have been understood and rendered obvious by IEEE802.3ah. DISH-1003, ¶¶94-104.

IEEE802.3ah's OLT (the first node) calculates RTT, which includes upstream and downstream propagation delays, based on "scheduled arrival clock time" (t_1) and "actual arrival clock time" (t_2). DISH-1003, ¶¶94-104. "The round trip delay computation is performed by the OLT,"—the first node—"using the timestamp in MPCP messages from the ONU." DISH-1005, 4. The RTT is "equal to the difference between the timer value and the value in the timestamp field." *Id.*, 427. The timer value is the OLT's (first node's) clock time upon receipt of the second message. *Id.*, Fig.64-4. This is the actual arrival time. DISH-1003, ¶¶94-104. As discussed in [1.b.i], a POSITA would have understood the "timestamp in MPCP messages from the ONU" is the "scheduled arrival clock time."[11] *Id.*

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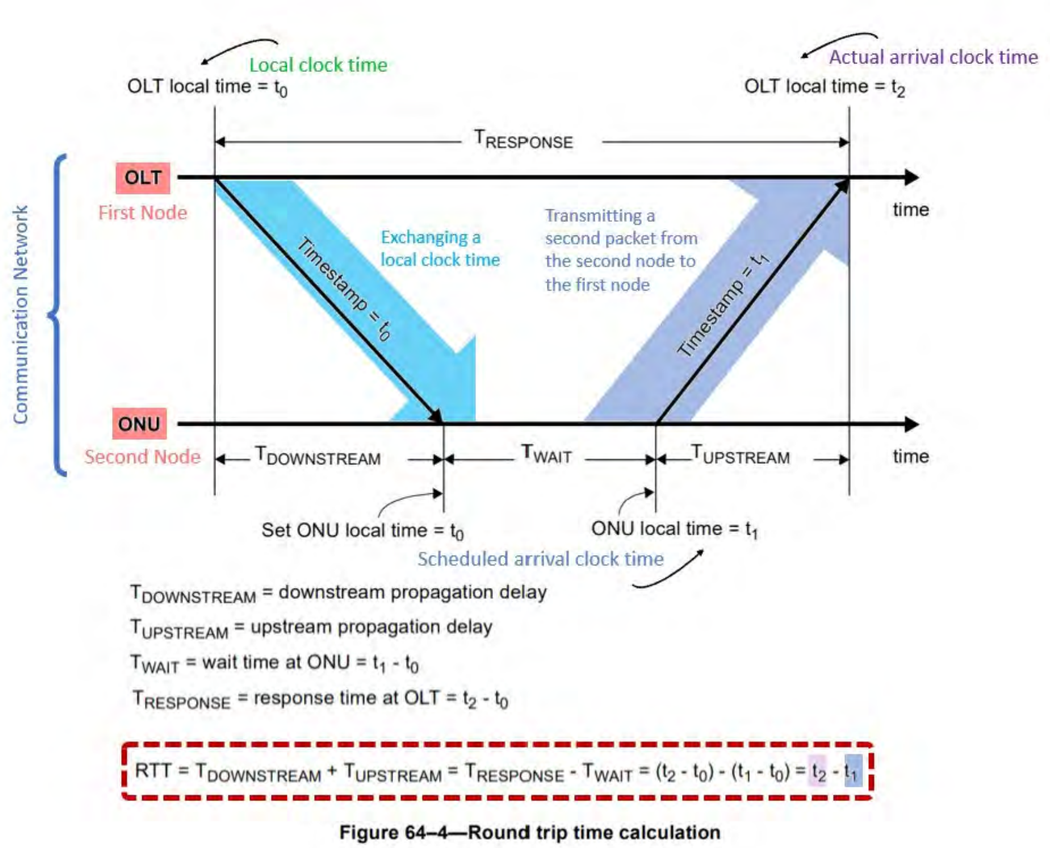
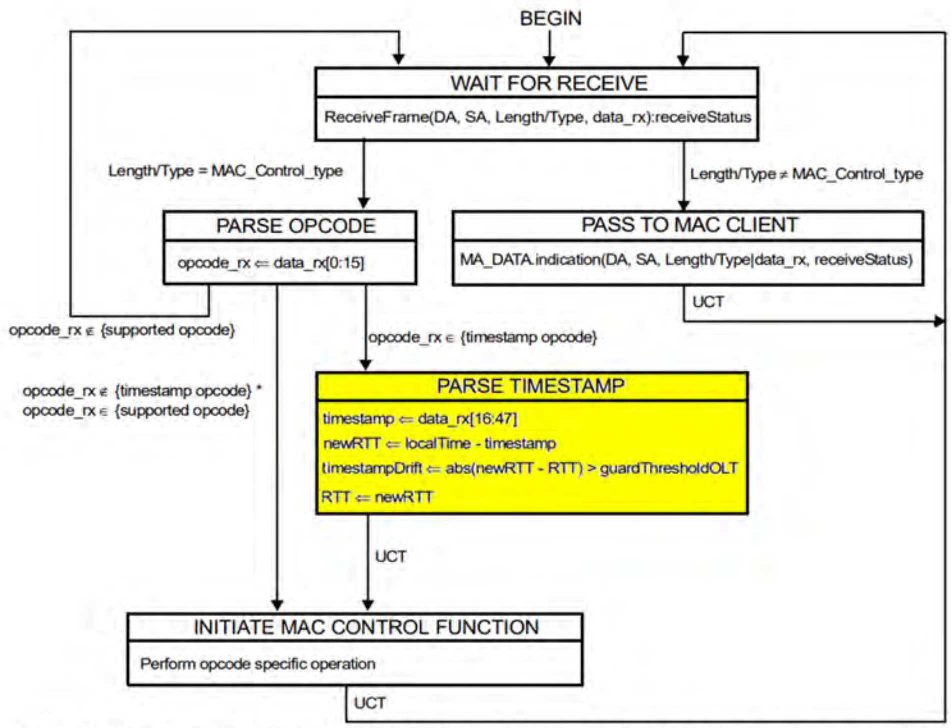
11 Specifically, ONU generates t_1 when the second packet is transmitted. DISH-1005, 427. The second packet is transmitted at the "grant start time" transmitted by OLT. DISH-1005, 455. These values are the "scheduled arrival clock time" of the claims because they are the response time transmitted by OLT and the time that ONU actually responded. DISH-1003, ¶¶94-104.



IEEE802.3ah Fig. 64-4 (annotated)

Figure 64-10 details the calculation of RTT. OLT calculates the variable “newRTT” by subtracting “timestamp” (t_1) from “localTime” (t_2) and then stores the result in “RTT.” DISH-1005, Fig.64-10. As discussed in [1.b.i] and footnote 12, localTime is the “actual arrival clock time” and the second packet’s timestamp is the “scheduled arrival clock time.”



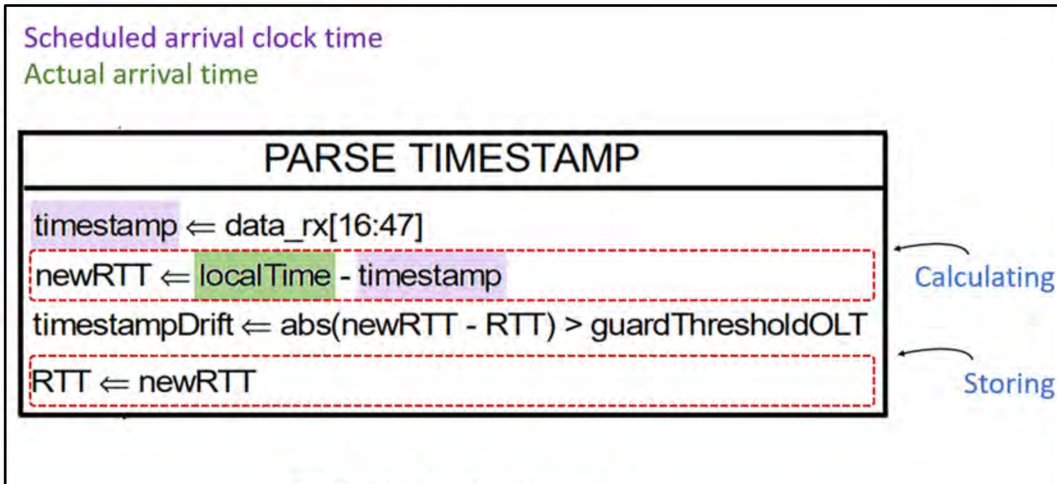
NOTE–The opcode-specific operation is launched as a parallel process by the MAC Control sublayer, and not as a synchronous function. Progress of the generic MAC Control Receive state machine (as shown in this figure) is not implicitly impeded by the launching of the opcode specific function.

Refer to Annex 31A for list of supported opcodes and timestamp opcodes.

Figure 64–10—OLT Control Parser state diagram

IEEE802.3ah Fig. 64-10 (annotated)

IEEE802.3ah teaches that RTT (which includes upstream and downstream propagation delays) is stored at OLT. DISH-1003, ¶¶94-104. For example, the RTT "variable holds the measured Round Trip Time to the ONU." DISH-1005, 432. A POSITA, therefore, would have understood IEEE802.3ah to disclose "storing the estimated propagation delay at the first node." DISH-1003, ¶¶94-104; DISH-1005, Fig.64-10.



IEEE802.3ah Fig. 64-10 (annotated)

It also would have been obvious to a POSITA to store the estimated propagation delay at the first node. DISH-1003, ¶¶94-104. A POSITA would have been motivated to store IEEE802.3ah's propagation delay because it would have been needed for subsequent use as described in [1.b]. *Id.* A POSITA would have experienced a reasonable expectation of success in implementing this functionality based on IEEE802.3ah's teaching of storing RTT. *Id.*

[1.b.iii] "transmitting a third packet from the first node to the second node, wherein the third packet comprises the estimated propagation delay; and"

IEEE802.3ah renders obvious [1.b.iii]. DISH-1003, ¶¶105-113. As discussed above, OLT calculates and stores RTT, including upstream and downstream propagation delays. Afterwards, RTT "is notified to the client via the MA_CONTROL.indication primitive," such that the "client can use this RTT for the ranging process." DISH-1005, 427; *id.*, 446 (describing that this primitive message

is "issued by the Discovery Process to notify the client" after calculating RTT); DISH-1003, ¶¶105-113. Figures 64-15 and 64-16 (below) show this. IEEE802.3ah clarifies that these messages are "generated by the Discovery Process in the OLT" and include "[t]he measured ***round trip time*** to/from the ONU." *Id.*, 446; DISH-1003, ¶¶105-113.

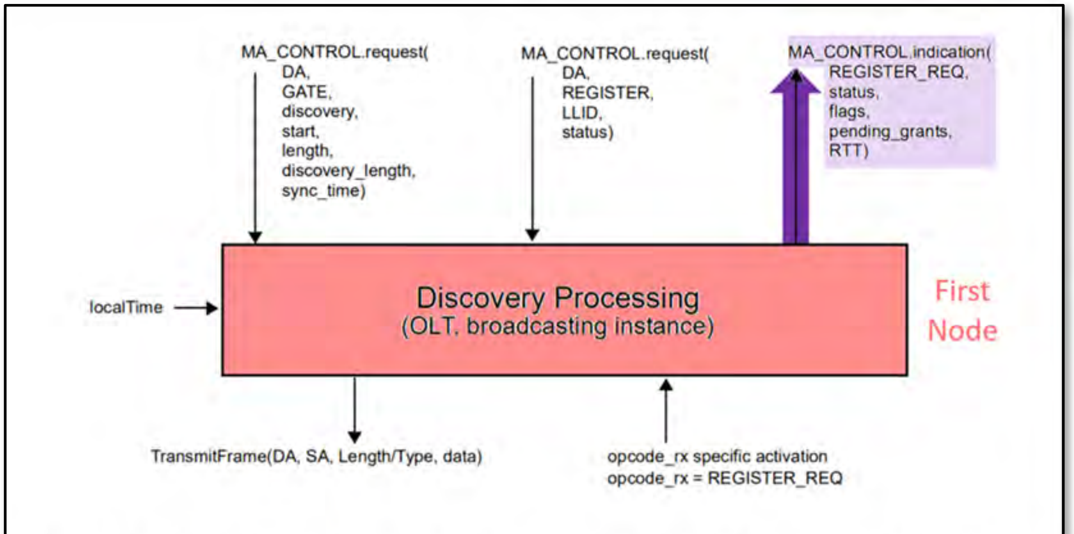
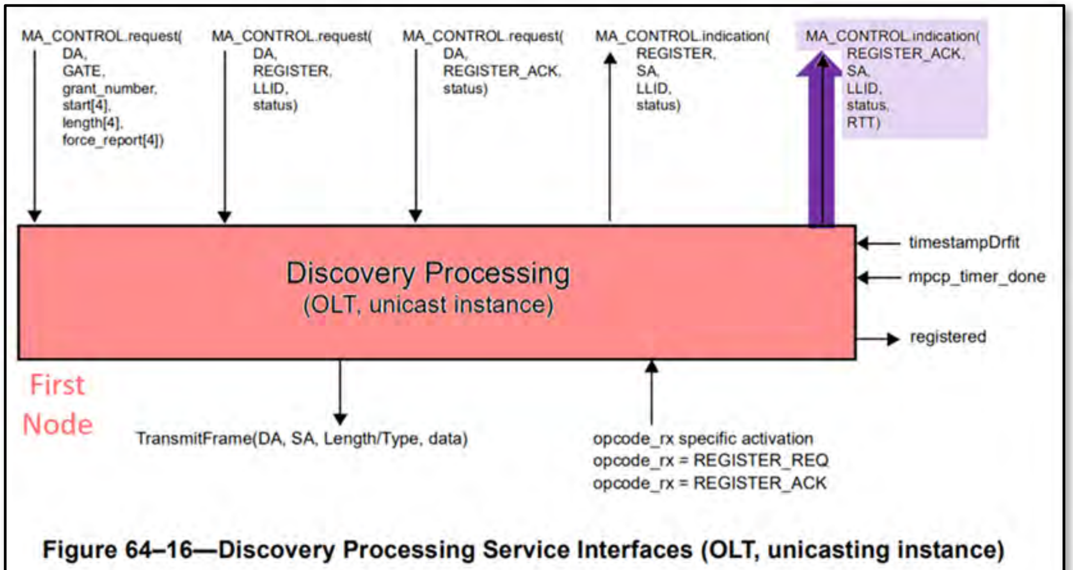


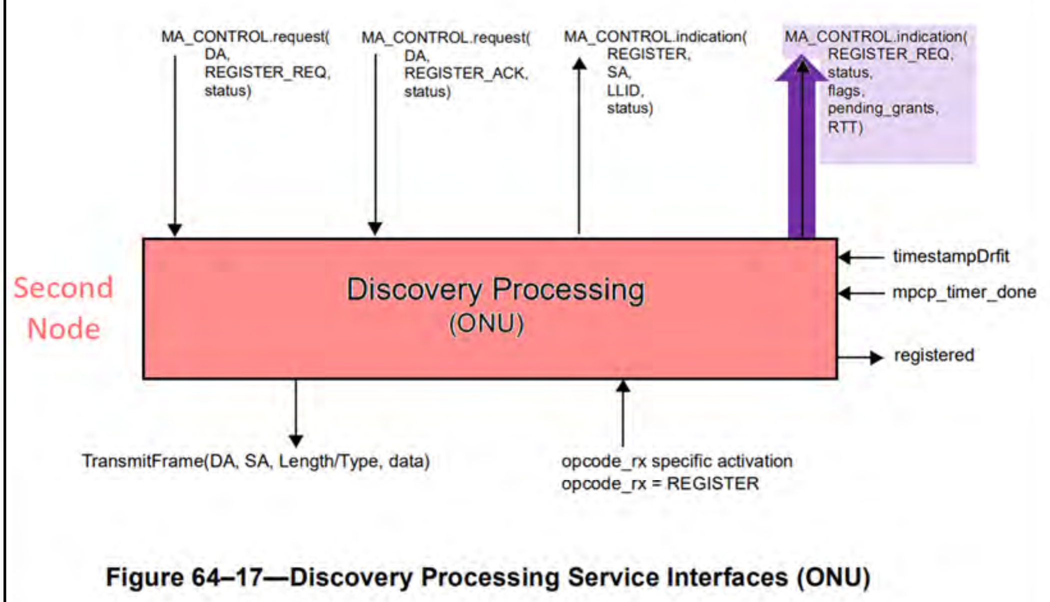
Figure 64–15—Discovery Processing Service Interfaces (OLT, broadcasting instance)

IEEE802.3ah Fig. 64-15 (annotated)



IEEE802.3ah Fig. 64-16 (annotated)

Figure 64-17 teaches that the ONU can possess RTT and can notify that value via the MA_CONTROL.indication. DISH-1005, Fig.64-17; DISH-1003, ¶¶105-113.



IEEE802.3ah Fig. 64-17 (annotated)

A POSITA would have understood that, for ONU to possess the calculated RTT, OLT must transmit it. DISH-1003, ¶¶105-113. IEEE802.3ah explains, "[w]hen ***the OLT*** receives MPCPDUs, ***it*** uses the received timestamp value to calculate or verify a round trip time between the OLT and the ONU." DISH-1005, 427; DISH-1003, ¶¶105-113. Accordingly, a POSITA would have understood that OLT necessarily transmits RTT to ONU as part of a "third packet" (after it has been measured) for ONU to possess it. DISH-1003, ¶¶105-113; DISH-1007 ¶¶27, 34.

As described above, IEEE802.3ah teaches that RTT includes propagation delay and therefore discloses or renders obvious the calculation and storage of an "estimated propagation delay." DISH-1003, ¶¶105-113.

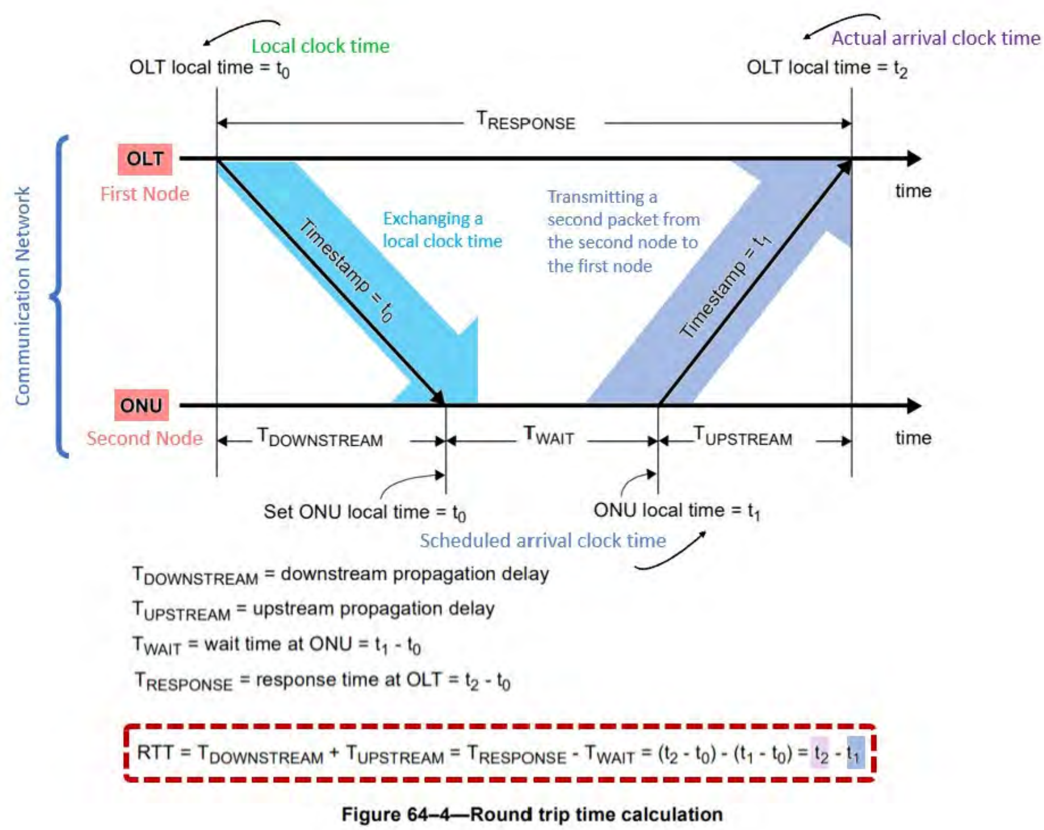
A POSITA would have found "transmitting a third packet … compris[ing] the estimated propagation delay," obvious. As discussed above, a POSITA would have understood it to be required to "transmit … the estimated propagation delay" to ONU for ONU to know what that propagation delay was. This system would have been more efficient because the ONU would be informed of the propagation delay between the nodes and would have used it for subsequent transmissions. A POSITA would have reasonably expected success because, as discussed above, IEEE802.3ah already disclosed transmitting from OLT to ONU. *Id.*

[1.c] "adjusting the local clock time of either the first or second node based on the estimated propagation delay, thereby resulting in a synchronized local clock time between the first and second node."

IEEE802.3ah renders obvious [1.c]. DISH-1003, ¶¶114-122. Nodes in the IEEE802.3ah network perform "[c]ontinuous ranging for compensating round trip time variation" to ensure that nodes' local clocks remain synchronized. DISH-1005, 422. This synchronization is the result of ranging. DISH-1005, 427 (explaining that the RTT "is notified to the client," so that the "client can use this RTT for the ranging process"). A POSITA would have understood that, to compensate for propagation delay—which has caused the local clock at ONU to be offset by the time taken for the GATE message to be transmitted from the OLT to the ONU—at least one of the nodes' clocks would have to be adjusted. DISH-1003, ¶¶114-120. Without

adjustment, the output of the ranging process would not be applied to the nodes. *Id*. As described above, this adjustment necessarily relies on either the downstream propagation or upstream propagation delay, not RTT. *Id*. A POSITA would therefore have been motivated to adjust the local clock time of the first or second node "based on the estimated propagation delay" to ensure clock synchronization across nodes. *Id*.

In Figure 64-4, ONU's local clock time is set to t_0, (i.e., the time according to OLT that OLT transmitted the GATE message) immediately upon receipt of the message. DISH-1005, Fig.64-4; DISH-1003, ¶¶114-120. Because the GATE message took some time to travel from OLT to ONU, OLT will no longer be at time t_0. DISH-1003, ¶¶114-120. The difference in their local clocks will be the time it took to travel from OLT to ONU, i.e., downstream propagation delay. DISH-1003, ¶¶114-120. The difference will not be the time it takes to travel from OLT to ONU and back to OLT, i.e., RTT. *Id*. It thus would have been obvious to a POSITA to adjust the local clock time of a node using propagation delay instead of RTT. *Id*.



IEEE802.3ah Fig. 64-4 (annotated)

A POSITA further would have understood that IEEE802.3ah contemplates synchronizing local clock times between the nodes based on IEEE802.3ah's Report Processing functionality. *Id.* For example, IEEE802.3ah teaches that "[f]ine control of the network bandwidth distribution can be achieved using feedback mechanisms supported in the Report Processing function." DISH-1005, 439. This Report Processing mandates that "Reports shall be generated periodically, even when no request for bandwidth is being made. This keeps a watchdog timer in the OLT from

expiring and deregistering the ONU. For proper operation of this mechanism the OLT shall grant the ONU periodically." *Id.* 452. A POSITA would have understood that this teaches a periodic synchronization using the range procedure discussed above and, as a result, that synchronization between the node clocks was required. DISH-1003, ¶¶114-120.

A POSITA would have reasonably expected success in adjusting the first or second node by the propagation delay because IEEE802.3ah already describes adjusting the local clock of the ONU (described in [1.a.ii]). *Id.* Therefore, a POSITA would have understood that the first or second node's local clock could have been further adjusted by the propagation delay (i.e., substitution of one known element—propagation delay plus timestamp—for another—timestamp—to obtain predictable results). *Id.*

4. Claim 2

IEEE802.3ah discloses claim 2, which recites in pertinent part "using the synchronized local clock time in subsequent packet transmissions between the first and second nodes." DISH-1003, ¶¶123-125.

As discussed in claim 1, IEEE802.3ah teaches a ranging method that synchronizes nodes by adjusting their local clock times. After the ranging process, the nodes' local clock times—or counter values—are synchronized, as described in analyzing claim 1 above. As a result of this synchronization, all future messages

will include synchronized timestamps. DISH-1003, ¶¶123-125. Specifically, IEEE802.3ah teaches that, when either OLT or ONU "transmits an MPCPDU, it maps its counter value into the timestamp field." DISH-1005, 4, 427. Accordingly, whenever a message is sent after synchronization, that message will include the synchronized local clock time in the timestamp field. DISH-1003, ¶¶123-125. Therefore, the synchronized local clock time would be used in subsequent packet transmissions. *Id.*

5. Claim 3

IEEE802.3ah renders obvious claim 3, which recites in pertinent part "adjusting the local clock times comprises storing the estimated propagation delay at the second node." DISH-1003, ¶¶126-129.

As discussed above with respect to, for example, [1.b]-[1.c], a POSITA would have found it obvious to rely on propagation delay to adjust local clock time based on IEEE802.3ah's teachings. §IV(A)(3); DISH-1003, ¶¶126-129.

A POSITA would have found it obvious that the second node would store propagation delay in order to use it. *Id*. A POSITA would have been motivated to store the value, and had a reasonable expectation of success, based on IEEE802.3ah's teachings that OLT stores RTT for use during calculations. *See* DISH-1005, 431-32 (storing RTT at OLT during calculations); DISH-1003, ¶126-

129. A POSITA would have implemented that procedure in ONU to store propagation delay while using it.

6. Claim 6

IEEE802.3ah discloses claim 6, which recites in pertinent part that "the first node is a network coordinator." DISH-1003, ¶¶130-133.

According to the '681 Patent, "[t]he network coordinator (NC) is relied upon to schedule all traffic on the network, thereby allocating the network bandwidth and avoiding packet collisions." DISH-1001, 2:37-39. IEEE802.3ah discloses that OLT acts as a network coordinator. DISH-1003, ¶¶129-32. IEEE802.3ah specifies that "[t]he OLT is the master entity in a P2MP network." DISH-1005, 4. "Grants are issued by the OLT (master) to ONUs (slaves)," *id.*, and there is only one OLT, *id.*, 180. This shows that OLT schedules all network traffic to avoid collisions. DISH-1003, ¶¶129-32.

7. Claim 7

IEEE802.3ah discloses claim 7, which recites in pertinent part that "the second node is a new node and the method is performed as part of admission of the second node to the communication network." DISH-1003, ¶¶134-136.

Like claim 7, IEEE802.3ah discloses that "[n]ew devices are discovered in the network and allowed transmission through the Discovery Processing function." DISH-1005, 439. IEE802.3ah describes that "[d]iscovery is the process whereby

newly connected or off-line ONUs are provided access." *Id.* 440-41. Because transmission of the new node is only allowed after the Discovery Processing function, including the ranging process, a POSITA would have understood that the ranging process is a part of admission of the second node (ONU). DISH-1003, ¶¶134-136.

8. Claim 8

IEEE802.3ah discloses claim 8, which recites in pertinent part that "the method is performed periodically to maintain synchronization between the first and second nodes." DISH-1003, ¶¶137-139.

IEEE802.3ah discloses that "[t]here may exist situations when the OLT requires that an ONU go through the discovery sequence again and reregister." DISH-1005, 441. IEEE802.3ah teaches that "[f]ine control of the network bandwidth distribution" is "achieved using feedback mechanisms supported in the Report Processing function." *Id.* 439. This Report Processing mandates that "Reports shall be generated periodically…. For proper operation of this mechanism the OLT shall grant the ONU periodically." *Id.* 452. A POSITA would have understood that this teaches a periodic synchronization using the range procedure discussed above. DISH-1003, ¶¶137-139.

9. Claims 9-10

IEEE802.3ah renders obvious claim 9, which recites in pertinent part that "the communication network is a mesh network," and claim 10, which recites in pertinent part that "the communication network operates in accordance with a Multimedia over Coax Alliance (MoCA) standard." DISH-1003, ¶¶140-145.

The patent explains that a "[m]esh topology" is one where "any node can communicate directly with any other node in the network." *Id.*; DISH-1001, 1:46-47; DISH-1003, ¶¶140-145. For example, the patent describes that "one Mesh topology is defined by the MoCA 1.0 standard." *Id.*, 2:2-3. The patent acknowledges that the disclosures of the MoCA 1.0 standard and MoCA 1.x specification were already generally known in the art. DISH-1001, 1:59-2:3. Based on a POSITA's understanding of MoCA's disclosures and IEEE802.3ah teachings, a POSITA would have been motivated and found it obvious to implement a "mesh network" in accordance with a MoCA standard because IEEE802.3ah is widely applicable to "subscriber access networks," which a POSITA would have understood includes coaxial cable networks that may implement a mesh topology. DISH-1003, ¶¶140-145. A POSITA would have reasonably expected success because IEEE802.3ah is intended to interface with a home network (e.g., a mesh network implementing MoCA) and therefore expected to be compatible with mesh and MoCA networks. DISH-1003, ¶¶140-145; *see* §§IV.E-F.

B. Ground 1B: Claims 11-13, 16-23, 26-33, 36-40 Are Rendered Obvious by IEEE802.3ah-Shvodian

1. Overview of Shvodian

Shvodian describes systems and methods for determining RTT "between a source node and a destination node" in a "home" network. DISH-1006, ¶¶[0001]-[0002]. Relevant here, Shvodian teaches a node (e.g., the source node) capable of instructing that a ranging procedure be performed between two other devices (e.g., a network bridge and the destination node). DISH-1003, ¶¶146-151.

Shvodian's "source node may be a content provider," while the "destination node may be a content sink." *Id.*, ¶[0002]. The "source node and the destination node" can be connected to each other via "a network bridge" using "existing cable infrastructure." *Id.*, ¶[0003]. The "existing cable infrastructure" can be a coaxial cable network. *See id.*, ¶[0016] (identifying "splitter 120" as a coaxial splitter), *id.*, ¶[0023] (identifying "first communication medium 130" as a coaxial cable).

Shvodian describes multiple approaches for determining RTT. *See id.*, ¶¶[0032]-[0040]. In one approach, the "source node" measures RTT by "transmit[ting] an RTT measurement packet to the destination node via the network bridges," and "receiv[ing] a response from … the destination node." *Id.*, ¶¶[0034]-[0035]. In another approach, RTT is measured using "a combination of [RTT] measurements and ranging operations between elements within the network. That

is, measuring [RTT] between the source node and the first bridge, performing ultra wide band ranging operation between the first bridge and the second bridge, measuring [RTT] between the second bridge and the destination node, and then reporting each of the [RTTs] and the ranging to the content source." *Id.*, ¶[0040].

2. IEEE802.3ah-Shvodian Combination

The IEEE802.3ah-Shvodian combination includes the networking protocol of IEEE802.3ah implemented with the teachings of Shvodian. For example, the combination incorporates Shvodian's teachings regarding the structure of coaxial cable networks, such that one device causes the ranging protocol of IEEE802.3ah to be implemented between two other nodes. *Id.*, ¶¶152-159.

Shvodian is analogous art to the '681 Patent and IEEE802.3ah because they are from the same field and Shvodian is reasonably pertinent to the problem addressed by the patent and IEEE802.3ah. *See Donner*, 979 F.3d at 1359.

First, like the patent and IEEE802.3ah, Shvodian's field is "transmissions between a source node and a destination node in a network," such as a "1394-over-coax bridged network," to determine RTT. DISH-1001, 1:15-19; DISH-1005, v, 4; DISH-1006, ¶¶[0001]-[0002], [0035]; DISH-1003, ¶¶150-151.

Second, Shvodian's disclosure of calculating RTT is "reasonably pertinent to the particular problem" of the patent and IEEE802.3ah. *Donner*, 979 F.3d at 1359; DISH-1003, ¶151. As discussed above, the patent and IEEE802.3ah seek to improve

network efficiency by determining propagation delay between nodes and then synchronizing their local clocks based on propagation delay. DISH-1001, 14:17-49; DISH-1005, Fig.64-4. One way to determine propagation delay is by first determining RTT, and Shvodian discloses a method for determining RTT. *See id.*, ¶¶[0032]-[0040]; DISH-1003, ¶¶146-151.

A POSITA would have been motivated to combine IEEE802.3ah and Shvodian because they both address the same problem of determining RTT. *Id.*, ¶¶151-58. IEEE802.3ah recognized that propagation delay could be calculated by first determining RTT. DISH-1005, FIG. 64-4; DISH-1003, ¶¶152-159.

To the extent the Patent Owner asserts that IEEE802.3ah alone does not render obvious the "network device" in claim 11 that comprises a "controller" that causes the ranging procedure to be performed, a POSITA would have been motivated to implement Shvodian's ranging between external nodes. *Id.*, ¶¶152-159.

Both references disclose the measurement of RTT. *Id.*, ¶¶151-58. IEEE802.3ah discloses that ranging is used to calculate RTT. DISH-1005, 427. Shvodian teaches two ways to perform ranging between source and destination nodes: (1) the source node measures RTT between it and a destination node; or (2) the source node measures RTT between it and a first bridge, then the source node measures RTT between a second bridge and the destination node, and then the source node sums those values. *See* §IV(B)(1).

To the extent Patent Owner asserts IEEE802.3ah does not specify what device initiates the ranging procedure (or the structural relationship between devices involved in ranging), Shvodian teaches the claimed network structures and implementations for performing ranging in those network structures. Based on Shvodian's teachings, a POSITA would have been motivated to have a network device include the structure of a device module and memory coupled to a controller that performs IEEE802.3ah's clock synchronization functions because this would further IEEE802.3ah's goals toward configuring nodes in a point-to-multipoint topology in an inexpensive implementation. DISH-1003, ¶¶152-159.

A POSITA would have had a reasonable expectation of success in combining IEEE802.3ah and Shvodian. *Id.*

The IEEE802.3ah and Shvodian networks were designed to interface with home-based electronics networks and each other. *Id.* Shvodian notes that its apparatuses and methods were "applicable to any wired ... communication network elements," including various IEEE protocols and coaxial cable networks. *See* DISH-1006, ¶¶[0015]-[0016]. IEEE802.3ah was designed to interface directly with these home-based networks. DISH-1003, ¶¶152-159. A POSITA would thus have understood Shvodian's network to be compatible with IEEE802.3ah's ranging protocol. *Id.*

Shvodian and IEEE802.3ah also both use RTT as part of performing ranging. DISH-1006, ¶¶[0032]-[0040]. Accordingly, Shvodian's teachings regarding how ranging devices in a network may be organized would clarify the implementation of IEEE802.3ah's ranging technique. DISH-1003, ¶¶152-159.

Given the straightforward application of Shvodian's teachings to IEEE802.3ah's ranging protocol, a POSITA would have had a reasonable expectation of success in combining IEEE802.3ah-Shvodian.

3. Claim 11

IEEE802.3ah-Shvodian renders obvious independent claim 11. DISH-1003, ¶¶160-194. Claim 11 recites "a network device" comprising "a controller," "a device module," "memory coupled to the controller" ([11.pre]-[11.c]), and a "computer executable program code" "to cause the controller to perform the functions" listed in [11.e]-[11.g]. *Id.*, ¶¶160-194. Limitations [11.e]-[11.g] are similar to limitations [1.a]-[1.c] and are rendered obvious for the same reasons shown for [1.a]-[1.c]. DISH-1003, ¶¶175-194. The substantively distinct features are addressed below. The table below maps the analysis of claim 1 to features of claim 11.

Element	**Analysis**
[11.e]	[1.a], [1.b.i]

[11.e.i]	[1.a.i]
[11.e.ii]	[1.a.ii]
[11.f]	[1.b], [1.a], [1.a.ii], [1.b.ii]
[11.f.i]	[1.b.i]
[11.f.ii]	[1.b.ii]
[11.f.iii]	[1.b.iii]
[11.g]	[1.c]

[11.pre] "A network device, comprising:"

To the extent the preamble is limiting, in the IEEE802.3ah-Shvodian combination, Shvodian discloses [11.pre]. DISH-1003, ¶¶160-162. Shvodian discloses a "source node" in a coaxial cable network. DISH-1006, ¶¶[0032], [0023]. A POSITA would have understood that a source node in a network is "a network device." DISH-1003, ¶¶160-162.

[11.a] "a controller;"

In IEEE802.3ah-Shvodian, Shvodian discloses [11.a]. DISH-1003, ¶162-64. Shvodian clarifies that the "source node" is also known as "network element 140A," which includes "an apparatus 200" including "a controller 210" that "can be one of a variety of different processors." DISH-1006, ¶¶[0019], [0032]; DISH-1003, ¶¶163-165.

[11.b] "a device module;"

In IEEE802.3ah-Shvodian, Shvodian discloses [11.b]. DISH-1003, ¶166-168.

According to the '681 Patent, a "device module" "is a black-box representation of the functionality that can be performed by the network device 520 and that may vary depending on that the nature of the actual device." DISH-1001, 12:48-51.

Shvodian discloses that the "source node" is also known as "network element 140A," which can be a "set top box." DISH-1006, ¶¶[0019], [0032]. Thus, a POSITA would have understood that the "source node" necessarily included components allowing it to perform functionalities in accordance with the nature of the "source node," e.g., components to enable a set top box to function. DISH-1003, ¶¶166-168.

[11.c] "memory coupled to the controller;"

In IEEE802.3ah-Shvodian, Shvodian discloses [11.c]. DISH-1003, ¶168-70.

Shvodian clarifies that the "source node" is also known as "network element 140A," which includes "an apparatus 200" including "memory 215." DISH-1006, ¶¶[0019], [0032]; DISH-1003, ¶¶169-171.

[11.d] "computer executable program code on a non-transitory computer readable medium configured to cause the controller to perform the functions of:"

In IEEE802.3ah-Shvodian, Shvodian discloses [11.d]. DISH-1003, ¶¶172-174.

As described in [11.c] Shvodian clarifies that "source node" includes "memory 215." DISH-1006, ¶¶[0019], [0032]. The "memory 215" can include "instructions such as computer programs which can be used for configuring the controller 210 to control the operation of the apparatus 200." *Id.*, ¶[0019]; DISH-1003, ¶¶172-174.

[11.e] "exchanging local clock times between a first node and a second node over a communication network, wherein the exchange comprises:"

IEEE802.3ah-Shvodian renders obvious [11.e]. DISH-1003, ¶175-182. Shvodian recognizes that RTT between a source node and a destination node can be determined as "a combination of [RTT] measurements and ranging operations between elements within the network. That is, measuring [RTT] between the source node and the first bridge, performing ultra wide band ranging operation between the first bridge and the second bridge, measuring [RTT] between the second bridge and the destination node, and then reporting each of the round trip times and the ranging to the content source." DISH-1006, ¶[0040]. Thus, in the IEEE802.3ah-Shvodian network, the "source node" is the claimed "network device" (*see* §IV(B)(3)

[11.pre]), the "second bridge" is the claimed "first node," and the "destination node" is the claimed "second node." DISH-1003, ¶¶175-182.

This limitation is identical to [1.a] except that it recites "exchanging local clock time***s***." As shown for [1.a], node 1's local clock time is transmitted to node 2. As shown for [1.b.i], node 2 sends a second message to node 1 including a timestamp, which lists node 2's local time at the time of sending. Accordingly, multiple local clock time***s*** are exchanged. *Id.*

[11.f] "performing a ranging method between the first and second nodes based on the local clock times exchanged between the first and second nodes, wherein the ranging method results in an estimated propagation delay between the first and second nodes, and wherein the ranging method comprises:"

IEEE802.3ah-Shvodian renders obvious [11.f]. DISH-1003, ¶¶183-194. This limitation differs from [1.b] in that it recites "performing a ranging method between the first and second nodes based on the local clock time***s*** exchanged ***between the first and second nodes***." As discussed in [11.e], multiple clock times are exchanged. The ranging method is based on these multiple clock times in that the first local clock time is used to reset the second node's local clock and the second local clock time, is used to perform the ranging calculation. *See* Sections IV(A)(3) (discussing [1.a.ii] and [1.b.ii]).

4. Claims 21, 31

IEEE802.3ah-Shvodian renders obvious independent claims 21 and 31. DISH-1003, ¶¶195-240. Claim 21 recites a computer program product (including a computer-readable-medium). Limitations [21.a]-[21.c] are similar to limitations [11.e]-[11.g] and are rendered obvious for the same reasons described above. DISH-1003, ¶¶197-213. Claim 21's preamble recites computer readable limitations similar to [11.d]. DISH-1003, ¶¶195-196.

Claim 31 recites a "network interface module" that includes a computer-readable-medium. DISH-1003, ¶¶214-240. All limitations of claim 31 other than the preamble are satisfied for the same reasons as the corresponding limitations of claim 11. *Id.*

The table below maps the analysis of claim 11 to corresponding features of claims 21 and 31.

Analysis	Element	Element
[11.a]		[31.a]
[11.c]		[31.b]
[11.d]		[31.c]
[11.e]	[21.a]	[31.d]
[11.e.i]	[21.a.i]	[31.d.i]

[11.e.ii]	[21.a.ii]	[31.d.ii]
[11.f]	[21.b]	[31.e]
[11.f.i]	[21.b.i]	[31.e.i]
[11.f.ii]	[21.b.ii]	[31.e.ii]
[11.f.iii]	[21.b.iii]	[31.e.iii]
[11.g]	[21.c]	[31.f]

[21.pre] "A computer program product comprising a non-transitory computer usable medium having computer readable program code embodied therein for synchronizing a plurality of nodes on a communication network, the compute[r] program product comprising computer readable program code configured to cause a device to:"

To the extent the preamble is limiting, Shvodian's teachings render obvious [21.pre]. DISH-1003, ¶¶195-196. As discussed in [11.d], IEEE802.3ah-Shvodian renders obvious a computer program product in the source node that includes a non-transitory computer usable medium with program code. *Id.*, ¶¶172-174; *see* §VI(A)(2)(iii)[11d]. That computer readable program code is configured to cause the device to perform the functionality of the remainder of claim 21 for the reasons described at the Sections shown in the table above. DISH-1003, ¶¶195-196.

[31.pre] "A network interface module, comprising:"

To the extent the preamble is limiting, Shvodian's teaching renders obvious [31.pre]. DISH-1003, ¶¶215-217. As discussed above, with respect to [11.pre], the

"source node" in Shvodian is a "network device." *See* §IV(B)(3)[11.pre] *supra*. Because the "source node" in Shvodian also includes "an interface 205," it is a "network interface module." DISH-1006, ¶[0019]; DISH-1003, ¶¶215-217.

5. Dependent Claims 12-13, 16-20, 22-23, 26-30, 32-33, 36-40

IEEE802.3ah-Shvodian renders obvious claims 12-13, 16-20, 22-23, 26-30, 32-33, and 36-40. DISH-1003, ¶¶241-254. The following claim groupings are substantively identical. *Id*.

- 2, 12, 22, and 32;
- 3, 13, 33, and 33;
- 6, 16, 26, and 36;
- 7, 17, 27, and 37;
- 8, 18; 28, and 38;
- 9, 19, 29, and 39; and
- 10, 20, 30, and 40.

DISH-1003, ¶¶241-254. As discussed above, IEEE802.3ah teaches or renders obvious each limitation of claims 2-3, 6-10; for that reason, IEEE802.3ah-Shvodian renders obvious claims 12-13, 16-20, 22-23, 26-30, 32-33, and 36-40. DISH-1003, ¶¶241-254.

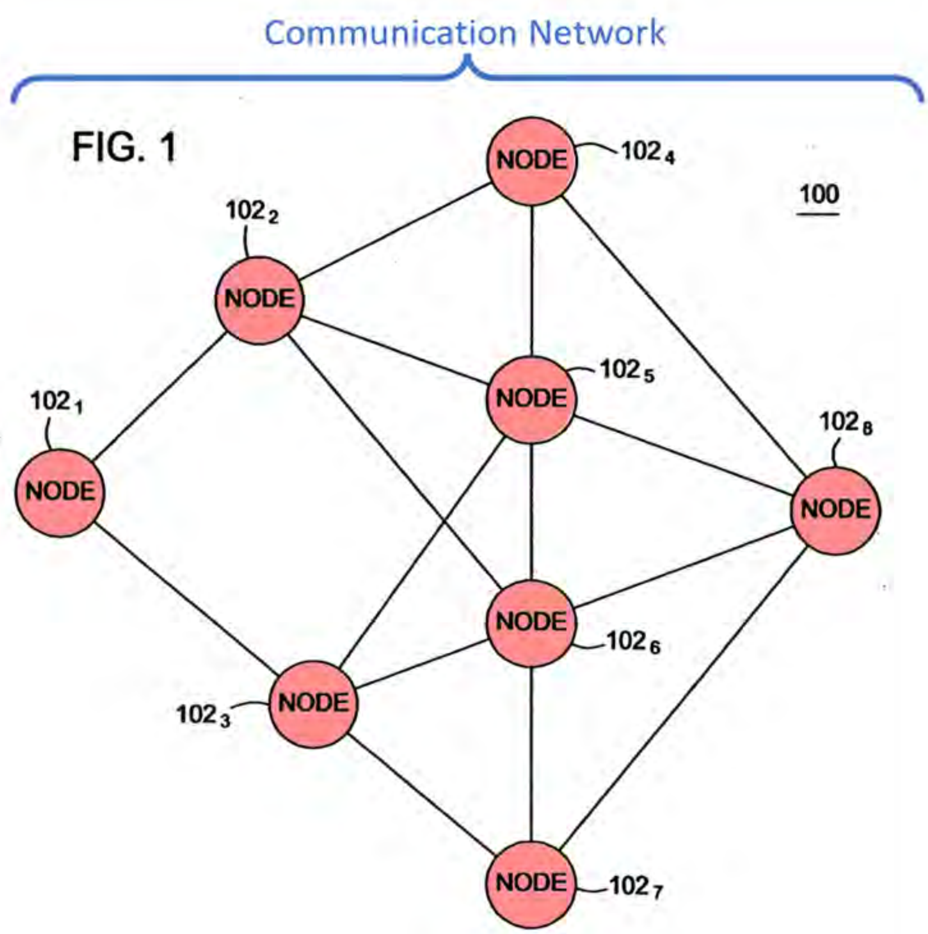
C. Ground 2A: Claims 1-3, 6-10 Are Rendered Obvious by IEEE802.3ah-Frei

Like IEEE802.3ah and Shvodian, Frei describes a network that synchronizes nodes' clocks using ranging. Each reference uses ranging to address problems purportedly overcome by the patent: avoiding packet collisions, ensuring bandwidth precision, and overcoming clock drift. DISH-1003, ¶¶254-406. To the extent Patent Owner asserts IEEE802.3ah and/or Shvodian does not render obvious the calculation (i.e., dividing RTT by 2 to get an "estimated propagation delay") and transmission of propagation delay, Frei renders those features obvious. *Id*.

1. Overview of Frei

Frei's network "determines the propagation delay between ... connected nodes" and "utilize[s] this information to more efficiently transfer data through the network." DISH-1007, Abstract. Frei teaches "a method and apparatus for improving the efficiency of a network and/or providing network monitory and management capability." DISH-1007, ¶9. It describes that, in some networks, nodes "receive[] and transmit[] data only during specific time slots" and, "where the distance between source and destination is unknown, the time slot must accommodate the worst case propagation delay." *Id.*, ¶¶6-7. This extended time slot creates inefficiency. *Id.*, ¶¶7-8; DISH-1003, ¶¶255-271.

Frei solves this problem using ranging. DISH-1003, ¶¶255-271. Specifically, "[t]o avoid such transmission inefficiency," Frei causes "timing information [to be] propagated outwards through the network 100 so that all nodes 102 are synchronized with their neighbor nodes." DISH-1007, ¶7, 27. These nodes are in Figure 1, "a graphical depiction of one embodiment of a network" "comprising connected nodes." *Id.*, ¶17.



Frei Fig. 1 (annotated)

Like the patent and IEEE802.3ah, Frei's synchronization involves sending messages back-and-forth between nodes and calculating the time elapsed. *Id.*, ¶¶29-36. In Frei's procedure, "the propagation delay may be measured by using time synchronized nodes and sending time of transmission information between nodes." *Id.*, ¶7. As a result, "any node can compute the propagation delay by subtracting the current time from the time of transmission." *Id.*

Propagation delay is then broadcast to the second node and used for clock synchronization. *Id.*, ¶37. Frei details this process. *Id.*, ¶¶29-37; DISH-1003, ¶¶255-271. The result is "synchronization of the destination node with the source node." DISH-1007, ¶41; *see id.* ("Ideally, because the clock of the source node has been synchronized with the clock of the destination node and offset by the propagation time between nodes, the received timestamp at the destination node should match the transmitted timestamp from the source node."). Figure 3 exemplifies this procedure.

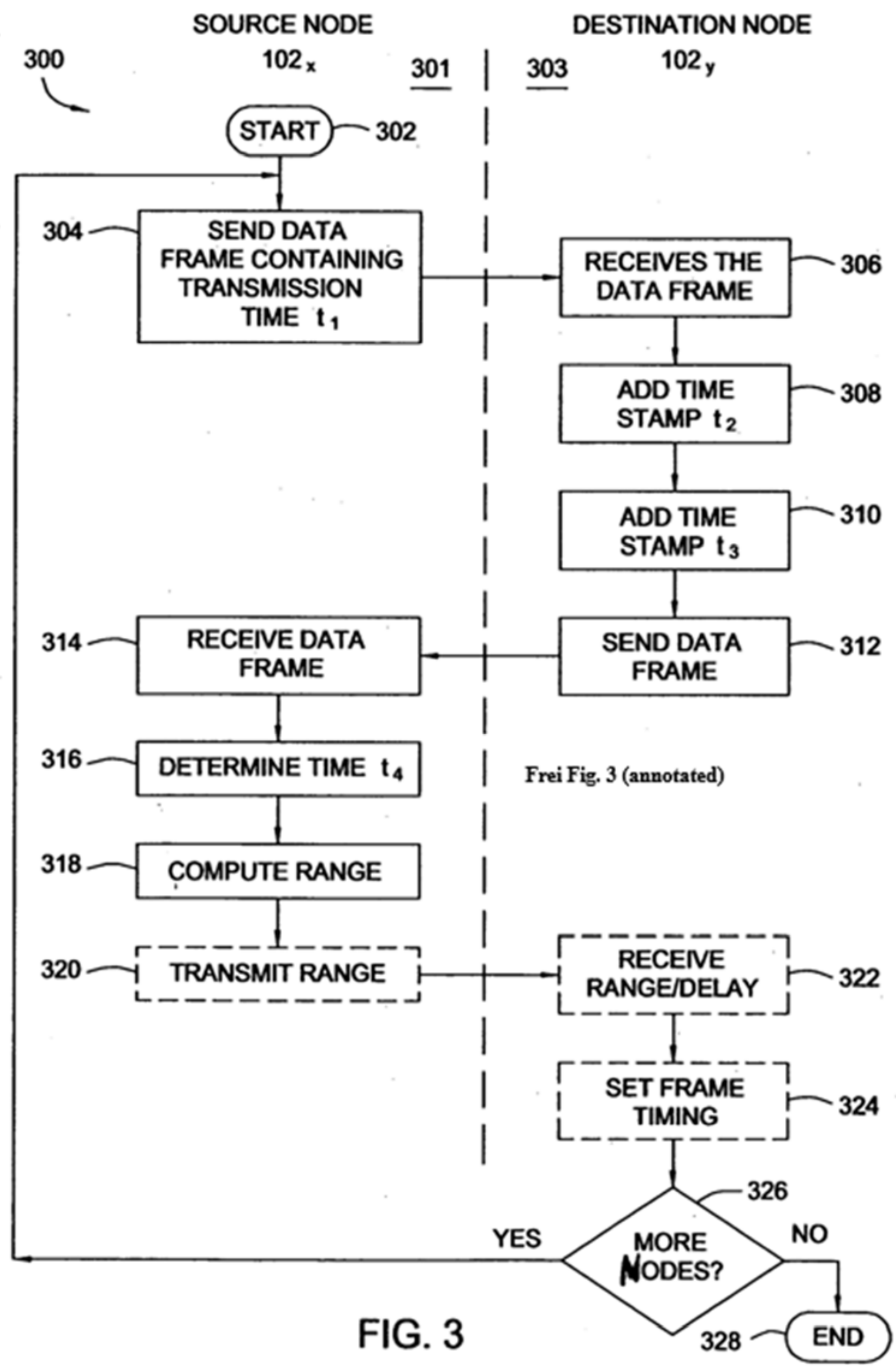
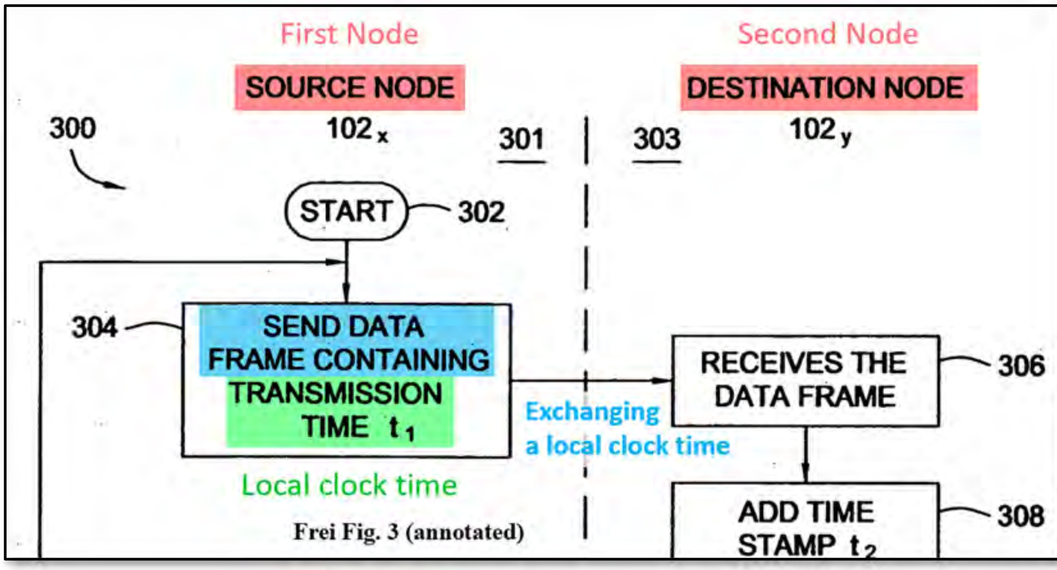


FIG. 3

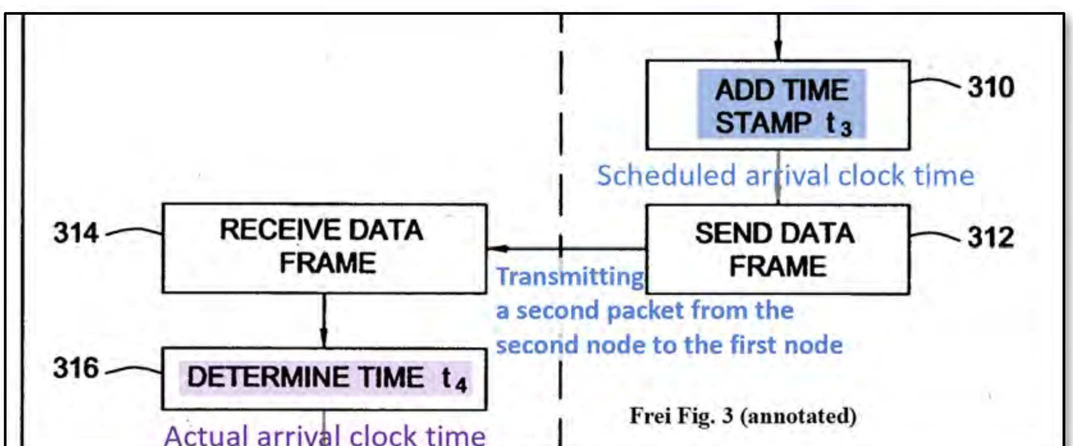
Frei Fig. 3

There, "a source node 102_x transmits a synchronization message" over the communication network of Figure 1, which "contains a time of transmission t_1" and "is addressed to destination node 102_y." *Id.*, ¶29. That packet arrives at t_2. *Id.*, ¶30.



Frei Fig. 3 (annotated)

Next, "destination node 102_y stamps the message with timestamp 410 containing the transmission time, t_3" and then "transmits a data frame 404 to the source node 102_x" at time t_3. *Id.*, ¶33. "[T]he source node 102_x receives the data frame 404" at "time t_4." *Id.*, ¶34.



Frei Fig. 3 (annotated)

After step 316, Frei calculates propagation delay, which is "well-known" to be "the time lag between the departure of transmitted data from a source node 102_1 and the arrival of the transmitted data at a destination node 102_2":

$$\text{Propagation delay} = (t_4 - t_1 - (t_3 - t_2))/2$$

Id., ¶23, 34.

The "source node 102_x transmits the range and/or the propagation delay to the destination node 102_y." *Id.*, ¶37, ¶24. "The destination node 102_2 uses the delay to delay the timeslot in which the destination node 102_2 will listen for a transmission from the source node 102_1." *Id.* This allows "synchronization between the two nodes [to be] achieved without a common time base." *Id.*, ¶25.

2. IEEE802.3ah(-Shvodian)-Frei Combinations

The IEEE802.3ah-Frei and IEEE802.3ah-Shvodian-Frei combinations include the networking protocol disclosed by IEEE802.3ah(-Shvodian) with clarification from Frei regarding certain implementation details. For example, the combination incorporates Frei's calculation of propagation delay from round-trip time and transmission of propagation delay to the second node.

Frei is analogous art to the ’681 Patent, IEEE802.3ah, and Shvodian because it is from the same field and is reasonably pertinent to the problem addressed by the ’681 Patent and the other references. *See Donner*, 979 F.3d at 1359.

First, like the ’681 Patent and the other references, Frei explains that its field “relate[s] to a network and, more specifically, to the efficient transfer of data through a network, as well as techniques for monitoring and management of a network.” DISH-1007, ¶2; DISH-1003, ¶¶268-271. Frei clarifies that “[t]hose skilled in the art will realize from [Frei’s] disclosure that other network topologies, both wired and wireless, may find benefit by using the present invention.” DISH-1007, ¶17. A POSITA would have understood that Frei is therefore intended for implementation in wired networks. DISH-1003, ¶¶255-271.

Second, the ’681 Patent and the other references seek to on improve network efficiency by minimizing unused bandwidth, or silent time. DISH-1001, 3:1-14 (stating networks become less efficient when nodes are not synchronized as a result of “several factors” “including but not limited to: delay in transmission …, propagation delay …, receive delay …, [and] clock drifts between nodes”).

This matches the motivation of Frei. Frei describes, “where the distance between source and destination is unknown, the time slot must accommodate the worst case propagation delay.” DISH-1007, ¶7. This “causes a portion of the time slot to be unutilized and the transmission of data is not as efficient as possible.” *Id.*,

¶6. Frei "avoid[s] such transmission inefficiency," by "comput[ing] the propagation delay." *Id.*, ¶7. Like the '681 Patent and other references, this procedure also corrects for "clock drift between the source node and the destination node," (*id.*, ¶41), and provides for accurate scheduling, (*id.*, ¶35).

That Frei can also be implemented in wireless networks does not prevent it from serving as analogous art. "[T]he reasonable-pertinence analysis must be carried out through the lens of a PHOSITA who is considering turning to art outside her field of endeavor." *Donner*, 979 F.3d at 1360; *id.* at 1361 (explaining that "a reference can be analogous art with respect to a patent even if there are significant differences between the two references"). Frei implements a ranging solution to overcome challenges present in both wireless and wired networks, expressly indicating that it can be implemented in a wired network; these are the challenges recited by the patent. DISH-1003, ¶¶255-271. Accordingly, a POSITA would have considered Frei to be analogous art. *Id.*

A POSITA would have been motivated to combine IEEE802.3ah(-Shvodian) and Frei because (i) they address the same network efficiency problems by providing similar node synchronization protocols, which implement back-and-forth ranging; and (ii) because they all provide ranging techniques including RTT and propagation delay. DISH-1003, ¶¶272-280.

First, all references were published close in time to address network efficiency problems facing the industry. *Id*. This is the same problem addressed and same solution offered by the '681 patent: "According to various embodiments of the disclosure, systems, methods and apparatuses are provided for ***using ranging to improve network efficiency***." DISH-1001, Abstract, 3:54-56; DISH-1003, ¶¶272-280. A POSITA would have been motivated to consider other references at the time to address network efficiency in ranging protocols.

Next, all three references disclose ranging used to measure RTT and propagation delay. *Id*. IEEE802.3ah discloses that ranging is used to calculate RTT, which includes propagation delay, (DISH-1005, 4, 427), as does Shvodian (DISH-1006, ¶[0040]). As described above, it would have been obvious to a POSITA from IEEE802.3ah(-Shvodian) to use propagation delay to synchronize network nodes because it is the amount that the secondary node's clock would need to be adjusted to match the first node's clock.

To the extent that IEEE802.3ah and/or Shvodian does not render obvious the calculation and transmission of propagation delay, a POSITA would have been motivated to look to references like Frei for clarification. Frei teaches a ranging procedure similar to IEEE802.3ah(-Shvodian), which—as described above with respect to Frei's disclosure—uses times associated with the departure and arrival of messages exchanged between nodes to determine RTT. *See* §IV(C)(1). After RTT

has been determined using IEEE802.3ah(-Shvodian)'s method, a POSITA would have been motivated to look to Frei, which expressly calculates propagation delay by dividing RTT in half and transmitting that propagation delay to other nodes for use. DISH-1007, ¶34; DISH-1003, ¶¶272-280.

$$\text{Propagation delay}=(t_4-t_1-(t_3-t_2))/2$$

A POSITA would have had a reasonable expectation that the IEEE802.3ah(-Shvodian)-Frei combination would have succeeded. *Id*. First, the references teach similar, compatible ranging protocols including calculation of RTT; a POSITA would therefore have expected a combination to be successful. *Id*. As described above, the teachings of IEEE802.3ah(-Shvodian) suggest that ranging may be used to calculate propagation delay; Frei provides this explicit calculation. *Id.*; DISH-1005, 4; DISH-1007, ¶34. As described above, a POSITA would have understood that propagation delay (rather than RTT) would be used to adjust the nodes' local clocks. DISH-1003, ¶¶272-280. A POSITA would have had no difficulty implementing the calculation performed by Frei (dividing by two) after RTT is calculated in IEEE802.3ah(-Shvodian). *Id*.

3. Claim 1

As discussed above, IEEE802.3ah renders obvious each limitation of claim 1 and, for that reason, IEEE802.3ah-Frei also renders obvious claim 1. DISH-1003, ¶281. The following limitations are also supported by Frei, further demonstrating that IEEE802.3ah-Frei renders obvious claim 1. DISH-1003, ¶¶281-308.

[1.b] "performing a ranging method between the first and second nodes based on the local clock time exchanged, wherein the ranging method results in an estimated propagation delay between the first and second node, and wherein the ranging method comprises:"

Frei's teachings render obvious [1.b]. DISH-1003, ¶¶286-292. In addition to IEEE802.3ah's calculation of RTT, Frei teaches dividing RTT in half to calculate propagation delay. DISH-1007, ¶34.

Frei explains that, "[a]s is well-known, propagation delay is the time lag between the departure of transmitted data from a source node 102_1 and the arrival of the transmitted data at a destination node 102_2." DISH-1007, ¶23. The ranging procedure of Frei is discussed above. §IV(C)(3). To calculate propagation delay, Frei describes that "a source node 102_x transmits a synchronization message 408," "contain[ing] a time of transmission t_1." DISH-1007, ¶29. That packet arrives at t_2. *Id.*, ¶30. Next, "the destination node 102_y stamps the message with timestamp 410 containing the transmission time, t_3," which is transmitted at t_3, "to the source node 102_x" to arrive at t_4. *Id.*, ¶33. As such, $(t_4 – t_1 – (t_3 – t_2))$ indicates

RTT. Frei then defines the propagation delay to be this RTT divided in half. DISH-1007, ¶34; DISH-1003, ¶¶286-292.

$$\text{Propagation delay} = (t_4 - t_1 - (t_3 - t_2))/2$$

A POSITA would have understood that Frei's method would be used to calculate propagation delay by dividing IEEE802.3ah's RTT in half and would have been motivated to use Frei's propagation delay calculation given that, once nodes "are aware of the propagation delay between each other, each node can time the transmission of data" such that, "synchronization between the two nodes is achieved without a common time base." *Id.*, ¶25; *see id.*, ¶24 ("Once determined, the source node 102_1 then transmits the propagation delay to the destination node 102_2."); DISH-1003, ¶¶286-292.

[1.b.ii] "calculating and storing the estimated propagation delay at the first node, wherein calculating the estimated propagation delay is based on the scheduled arrival clock time and the actual arrival time, and"

In the IEEE802.3ah-Frei combination, Frei's teachings render obvious [1.b.ii]. DISH-1003, ¶¶294-298. As discussed above in [1.a.i], IEEE802.3ah discloses a "scheduled arrival clock time." In addition to the teachings of IEEE802.3ah, Frei discloses estimating propagation delay at the first node by dividing RTT in half. *Id.* At time t_4, the first node receives a packet from the second

node including the time that packet was sent. DISH-1007, ¶34. Frei provides the calculation used to derive propagation delay.

$$\text{Propagation delay}=(t_4-t_1-(t_3-t_2))/2$$

A POSITA would have found it obvious to use Frei's propagation delay methods with IEEE802.3ah and, effectively, dividing 802.3ah's RTT by 2 to determine the "estimated propagation delay." To perform this calculation, a POSITA would have understood that Frei stores the propagation delay. DISH-1003, ¶¶294-298. A POSITA would have understood that, in order to transmit propagation delay, it must be stored. *Id*.

[1.b.iii] "transmitting a third packet from the first node to the second node, wherein the third packet comprises the estimated propagation delay; and"

In the IEEE802.3ah-Frei combination, Frei discloses [1.b.iii]. DISH-1003, ¶¶299-302. In addition to the teachings of IEEE802.3ah, Frei discloses that "the source node 102_x transmits the range and/or the propagation delay to the destination node 102_y." *Id.*, ¶37; *see also id.*, ¶24; DISH-1003, ¶¶299-302.

[1.c] "adjusting the local clock time of either the first or second node based on the estimated propagation delay, thereby resulting in a synchronized local clock time between the first and second node."

In the IEEE802.3ah-Frei combination, Frei discloses [1.c]. DISH-1003, ¶303-308. Frei teaches that "the source node 102_1 then transmits the propagation delay to the destination node 102_2. ***The destination node*** $\boldsymbol{102_2}$ ***uses the delay to delay the timeslot in which the destination node*** $\boldsymbol{102_2}$ ***will listen for a transmission from the source node*** $\boldsymbol{102_1}$***.***" DISH-1007, ¶24; *see id.*, ¶37.

As discussed above, IEEE802.3ah's technique synchronizes nodes by changing the local clock times. DISH-1003, ¶¶303-308. A POSITA would have understood that, in the context of IEEE802.3ah, the way to "delay the timeslot," as disclosed by Frei, would be to adjust the nodes local clock time by the estimated propagation delay. *Id*.

4. Claims 2-3, 6-10

As discussed above, IEEE802.3ah renders obvious each limitation of claims 2-3, 6-10 and for that reason, IEEE802.3ah-Frei also renders obvious those claims. DISH-1003, ¶¶309-323.

5. Claim 9

In IEEE802.3ah-Frei, Frei additionally provides disclosure for claim 9, which recites that the network is "a mesh network." DISH-1003, ¶¶319-321. Frei discloses

that "[a]n exemplary network that may utilize and benefit from the present invention is a mesh network." DISH-1007, ¶17.

D. Ground 2B: Claims 11-13, 16-23, 26-33, 36-40 Are Rendered Obvious by IEEE802.3ah-Shvodian-Frei

1. Claims 11, 21, and 31

IEEE802.3ah-Shvodian-Frei renders obvious claims 11, 21, and 31. DISH-1003, ¶¶324-392; *see also* §IV(C)(1)-(2) (providing overview of Frei and explaining motivation to combine IEEE802.3ah-Shvodian with Frei). As discussed above, IEEE802.3ah-Shvodian renders obvious each limitation of claims 11, 21, and 31 and, for that reason, IEEE802.3ah-Shvodian-Frei also renders obvious claims 11, 21, and 31. *Id.*

As explained above, limitations [11.f]/[21.b]/[31.e], [11.f.ii]/[21.b.ii]/[31.e.ii], [11.f.iii]/[21.b.iii]/[31.e.iii], and [11.g]/[21.c]/[31.f] (reciting similar steps as [1.b], [1.b.ii], [1.b.iii], and [1.c] respectively) are also supported by Frei, further demonstrating that IEEE802.3ah-Shvodian-Frei renders obvious claim 1. *Id.*

2. Claims 12-13, 16-20, 22-23, 26-30, 32-33, and 36-40

IEEE802.3ah-Shvodian-Frei renders obvious claims 12-13, 16-20, 22-23, 26-30, 32-33, and 36-40. DISH-1003, ¶¶393-406. As discussed above, IEEE802.3ah-Frei renders obvious each limitation of claims 2-3, and 6-10, and IEEE802.3ah-

Shvodian renders obvious claims 11, 21, and 31. *See* §§IV(A)(4)-(9), (B)(3)-(4). For that reason, IEEE802.3ah-Shvodian-Frei also renders obvious claims 12-13, 16-20, 22-23, 26-30, 32-33, and 36-40. DISH-1003, ¶¶393-406.

E. Ground 3A: Claims 9-10 Are Rendered Obvious by IEEE802.3ah-Frei-Ovadia

Ovadia describes a network in which it would have been obvious to a POSITA to implement IEEE802.3ah-Frei or IEEE802.3ah-Shvodian-Frei. DISH-1003, ¶¶407-418. Ovadia overviews the properties of a MoCA 1.0 network, describing a home-based, point-to-point network intended for multimedia communication. A POSITA would have found it obvious to implement IEEE802.3ah-Frei and IEEE802.3ah-Shvodian-Frei in the network of Ovadia. *Id*.

1. Overview of Ovadia

Ovadia describes the features and basic implementation of a home MoCA 1.0 network. DISH-1003, ¶¶404-410. MoCA 1.0 is designed to be used in a home where "multimedia signal enters the home via an optical termination unit (ONT)." DISH-1008, 1. When implemented, Ovadia describes that MoCA 1.0 can provide "reliable room-to-room, peer-to-peer, [and] full-mesh connectivity among all sources and sinks in the home." *Id.*; *see id.*, 5.

According to Ovadia, a MoCA 1.0 "network supports communications up to 8 nodes," where any "node can become a network coordinator," and that node

"broadcasts beacons … to enable other MoCA nodes to detect the presence of a network, and join the network." *Id.*, 2-3. Ovadia explains that "[e]very MoCA node must go through an admission process, before becoming part of the MoCA network," and once that is complete, the network coordinator will "control[] all the transmissions in the network by broadcasting scheduled transmission opportunities to every node in a control packet called a MAP." *Id.*, 3.

2. IEEE802.3ah(-Shvodian)-Frei-Ovadia Combination

The IEEE802.3ah(-Shvodian)-Frei-Ovadia combination includes the networking protocol of IEEE802.3ah(-Shvodian)-Frei implemented with the teachings of Ovadia. For example, the combination incorporates Ovadia's express teachings regarding the properties of a MoCA network, such that the ranging protocol of IEEE802.3ah(-Shvodian)-Frei is implemented in a MoCA network. DISH-1003, ¶¶411-418.

Ovadia is analogous art to the '681 Patent and the other references because they are from the same field. *Id*. The patent "relates to networks, and more particularly, some embodiments relate to using range estimates to improve efficiency in networks, particularly networking over coaxial cable." DISH-1001, 1:15-18. IEEE802.3ah, Shvodian, and Frei likewise relate to multi-node communication networks implementing similar efficiency protocols. DISH-1003, ¶410. The patent specifically identifies MoCA 1.0 and MoCA 1.x as networks to

which the patent's efficiency teachings could be applied. DISH-1001, 1:59-4:19. Ovadia describes the properties of these MoCA 1.0 networks. *See generally* DISH-1008.

A POSITA would have been motivated to combine IEEE802.3ah(-Shvodian)-Frei with Ovadia because they are intended for implementation in the home and related wiring types. DISH-1003, ¶¶411-418. Sometimes called "Ethernet in the First Mile," IEEE802.3ah is intended to interface with the end user's equipment in local and metropolitan networks. *Id*. In other words, IEEE802.3ah is designed to interface with the home. *Id*. Like IEEE802.3ah, Ovadia describes that MoCA was "rapidly emerging as the de-facto standard in North America for multimedia home networking." DISH-1008, Abstract; DISH-1003, ¶¶411-418. As described here and above, all references, therefore, describe network interfaces related to a user's home. *Id*.

Moreover, MoCA is designed to interface with Ethernet. DISH-1008, 3 ("The primary function of an intermediate device is to bridging of user content between the MoCA network and an external device using an industry standard interface such as Ethernet or USB."); DISH-1003, ¶¶411-418. Accordingly, a POSITA would have understood that the communication network of IEEE802.3ah, and also Shvodian and Frei, which are compatible with IEEE802.3ah, are intended to be compatible with the network of Ovadia. *Id*.

A POSITA would have been motivated to apply the synchronization of nodes' clocks in communication networks where propagation delay can cause inaccuracy, such as in coaxial cable networks. *See* DISH-1001, 3:1-14 (recognizing inaccuracies in MoCA 1.0 clock time due to propagation delay); *see* DISH-1006, FIG. 3, DISH-1013, 12 (File Wrapper of '676 Provisional Application (which the '681 Patent claims priority to) discusses the preexisting MoCA 1.x standard and notes that "[p]ropagation delay is the largest source of inaccuracy in CTC synchronization and packet arrival time").

In light of this, a POSITA would have been motivated to modify the home network of Ovadia to benefit from the network efficiencies of IEEE802.3ah (-Shvodian)-Frei, which are intended for implementation in local and metropolitan networks. DISH-1003, ¶¶411-418. The efficiency ranging protocol of IEEE802.3ah was already being used in the network interfacing with the home; a POSITA would have been motivated to extend that efficiency into the adjacent network. *Id.* For example, implementing similar protocols in networks that are communicating with each other can lead to superior connection and compatibility. *Id.* A POSITA would have been motivated to achieve such improved compatibility.

A POSITA would have had a reasonable expectation that the IEEE802.3ah (-Shvodian)-Frei-Ovadia combination would have succeeded. *Id.* The IEEE802.3ah(-Shvodian)-Frei network and the Ovadia networks were designed to

interface with the home and, in fact, interface with each other. *Id.* A POSITA would have expected that communicating protocols would benefit from mirroring efficiency schemes. *Id.*

A POSITA would have also expected success given that MoCA 1.0 (Ovadia's subject-matter) already included a synchronization protocol. DISH-1001, 2:60-3:14. Accordingly, the home network of Ovadia would be improved by implementing the ranging protocol taught by IEEE802.3ah(-Shvodian)-Frei in lieu of its present procedure. *Id.* A POSITA would have expected that a network system already designed to synchronize nodes would benefit from adjusting to adopt a ranging protocol to improve its accuracy. *Id.*

Given the straightforward application of IEEE802.3ah(-Shvodian)-Frei's teachings to Ovadia's network, a POSITA would have expected the IEEE802.3ah (-Shvodian)-Frei-Ovadia combination to be successful.

3. Claim 9

In the IEEE802.3ah-Frei-Ovadia combination, Ovadia additionally discloses Claim 9, which recites "the communication network is a mesh network." DISH-1003, ¶¶419-422.

The '681 Patent explains that a "[m]esh topology" is one where "any node can communicate directly with any other node in the network." DISH-1001, 1:46-47. For example, the patent describes that "one Mesh topology is defined by the MoCA

1.0 standard." *Id.*, 2:2-3. Ovadia discloses the mesh network of MoCA 1.0, explicitly providing that MoCA 1.0 "is based on distributed mesh network architecture," and has been "shown to provide a reliable room-to-room, peer-to-peer full mesh connectivity" between devices. DISH-1008, 2, 5; DISH-1003, ¶¶419-422.

4. Claim 10

In the IEEE802.3ah-Frei-Ovadia combination, Ovadia additionally discloses Claim 10, which recites that "the communication network operates in accordance with a Multimedia over Coax Alliance (MoCA) standard." DISH-1003, ¶¶423-425.

Ovadia discloses implementation of the MoCA 1.0 standard. DISH-1008, 1-5. A POSITA would have understood and found it obvious to use a home network, as disclosed by Ovadia, to implement the ranging protocol taught by IEEE802.3ah-Frei-Ovadia. Ovadia clarifies that a home network can be a MoCA network. DISH-1008, Abstract (MoCA was "rapidly emerging as the de-facto standard in North America for multimedia home networking"). It would thus have been obvious to a POSITA that a MoCA network, such as the one in Ovadia, would implement the ranging protocol taught by IEEE802.3ah-Frei. DISH-1003, ¶¶423-425.

F. Ground 3B: Claims 19-20, 29-30, 39-40 Are Rendered Obvious by IEEE802.3ah-Shvodian-Frei-Ovadia

IEEE802.3ah-Shvodian-Frei renders obvious claims 19-20, 29-30, and 39-40. DISH-1003, ¶¶426-429; *see also* §IV(E)(1)-(2) (providing overview of Ovadia

and explaining motivation to combine IEEE802.3ah-Shvodian-Frei with Ovadia). As discussed above, IEEE802.3ah-Frei-Ovadia renders obvious each limitation of claims 9-10 and IEEE802.3ah-Shvodian-Frei renders obvious claims 11, 21, and 31. *See* §§IV(D)(1), (E)(3)-(4). For that reason, IEEE802.3ah-Shvodian-Frei-Ovadia also renders obvious claims 19-20, 29-30, 39-40. DISH-1003, ¶¶426-429.

G. Ground 4A: Claims 4-5 Are Rendered Obvious by IEEE802.3ah-Frei-Smith

Smith describes a procedure for measuring the arrival time of packets in a network. DISH-1009, Abstract. The procedure relies on the average delay between sending and receiving a packet, using a mechanism similar to and compatible with the networks employed by IEEE802.3ah(-Shvodian)-Frei. DISH-1009, 6:51-62; DISH-1003, ¶¶430-437. A POSITA would have found it obvious to modify IEEE802.3ah(-Shvodian)-Frei with the teachings of Smith regarding "mean delay" to render obvious claims 4-5, 14-15, 24-25, 34-35. DISH-1003, ¶¶438-444.

1. Overview of Smith

Smith discloses techniques for measuring packet timing in networks. DISH-1009, 6:51-61. Recognizing that network node synchronization is critical, Smith describes a "solution[]" that accounts for "variations in network operation affecting the packet stream." DISH-1009, 1:58-65, 2:51-3:14, 4:37-50. Smith teaches that it can be implemented in wired networks (like T1) and wireless networks (like GSM).

Id., 1:38-65. Importantly, Smith further recognizes that its methodology is "generally applicable to any derived timing signals, such as IEEE 1588 Precision Time Protocol." *Id.*, 5:58-6:2; DISH-1003, ¶¶430-437.

Smith's solution is similar to the procedure described by IEEE802.3ah, Shvodian, and Frei. Smith calculates each packet's delay using the difference between the "packet time-stamps" and the "packet arrival times." DISH-1009, 6:51-61; DISH-1003, ¶¶430-437. This "solution[]," however, is intended to account for "variations in network operation." DISH-1009, 4:37-50. Accordingly, Smith teaches that "relative delay" may be derived from "a mean delay of the pseudowire packet arrival times," rather than the "pseudowire packet arrival times." *Id.*, 6:51-61, 8:58-63, 9:8-13; DISH-1003, ¶¶430-437.

2. IEEE802.3ah(-Shvodian)-Frei-Smith Combination

The IEEE802.3ah(-Shvodian)-Frei-Smith combination includes the networking protocol of IEEE802.3ah(-Shvodian)-Frei combined with the teachings of Smith. For example, the combination incorporates Smith's express teachings regarding the use of mean delay to measure the arrival and transmission time of network packets. DISH-1003, ¶¶438-444. To ensure that propagation delay is accurately calculated by IEEE802.3ah(-Shvodian)-Frei, the claimed first packet clock time, scheduled arrival clock time, and the actual arrival clock time must be accurate. A POSITA would therefore have implemented the teachings of Smith,

which is directed to the "estimation and monitoring of timing errors from packet data networks," to ensure that the measurement of the claimed times are precise. DISH-1009, 1:8-9; *Id*. A POSITA would have recognized that relying on the "mean delay" taught by Smith, instead of the measured arrival time or transmission time, would merely require a simple additional step: averaging the previous arrival time delays and substituting that value into the procedure of IEEE802.3ah-Frei. *Id*.

Smith is analogous art to the '681 Patent and other references because it is from the same field and it is reasonably pertinent to the problem addressed by the '681 Patent and those references. *See Donner*, 979 F.3d at 1359; DISH-1003, ¶¶434-437.

First, like the '681 Patent and other references, Smith's field of invention is "estimation and monitoring of timing errors from packet data networks." DISH-1009, 1:7-13; DISH-1003, ¶¶434-437.

Second, Smith's disclosure of a solution for accurately measuring packet arrival to synchronize nodes is "reasonably pertinent to the particular problem" of the '681 patent. *Donner*, 979 F.3d at 1359; DISH-1003, ¶¶434-437. The '681 patent discloses the use of "ranging to improve local clock time synchronization." DISH-1001, 1:56-58. This ranging involves sending messages back-and-forth between nodes and measuring the packets' arrival time. DISH-1003, ¶¶434-437. One facet of this problem's solution, accordingly, is how to measure the time a packet arrives.

DISH-1001. The patent describes multiple approaches, including measuring "arrival time of a received packet" according to "a mean delay of the received signal." *Id.*, 4:55-67.

These same factors and goals motivate Smith's procedures. DISH-1003, ¶¶434-447. Smith explains that proper functionality of networks can "rely on the synchronization" and "timings" of various network nodes and the messages sent between them. DISH-1009, 2:51-3:14. Accordingly, Smith discloses mechanisms for measuring the arrival time of various packets to account for delay and variation. DISH-1009, 6:62-7:7; DISH-1003, ¶¶434-447. These include measuring the arrival time of transmitted messages based on the "mean delay." DISH-1009, 6:62-7:7. In light of that, a POSITA would have considered Smith to be analogous art.

A POSITA would be motivated to combine IEEE802.3ah(-Shvodian)-Frei with Smith because they address the same problem—network timing synchronization—using similar properties—actual packet timing compared against scheduled packet timing. DISH-1003, ¶¶438-444. For example, IEEE802.3ah (-Shvodian)-Frei improves network efficiency by measuring the delay in transmitting or receiving packets in a network. *Id*. IEEE802.3ah(-Shvodian)-Frei precisely measures the time required to transmit messages between two nodes. *Id*.

A POSITA interested in precisely measuring the timing required to transmit messages necessarily would have been interested in a mechanism for precisely

measuring the time of transmission or reception. *Id*. Smith provides a methodology for refining that measurement. *Id.*; DISH-1009, 4:55-67.

A POSITA would have further been motivated to combine the teachings of IEEE802.3ah(-Shvodian)-Frei with Smith given that they rely on the same properties. IEEE802.3ah(-Shvodian)-Frei's ranging protocol relies on scheduled and actual message timing attributes. DISH-1003, ¶¶438-444. Similarly, Smith relies on message "time-stamps"—i.e., scheduled timing—and actual "arrival times." DISH-1009, 6:62-7:7; DISH-1003, ¶¶438-444.

In light of this, a POSITA would have been motivated to implement the packet measurement methodology of Smith in the procedure of IEEE802.3ah(-Shvodian)-Frei. DISH-1003, ¶¶438-444.

A POSITA would have reasonably expected the IEEE802.3ah(-Shvodian)-Frei-Smith combination to have a successful outcome. *Id*.

Both IEEE802.3ah(-Shvodian)-Frei and Smith rely on the same properties. IEEE802.3ah(-Shvodian)-Frei's ranging protocol relies on scheduled and actual message timing attributes. *Id*. Similarly, Smith relies on message "time-stamps"—i.e., scheduled timing—and actual "arrival times." DISH-1009, 6:62-7:7; DISH-1003, ¶¶438-444.

Accordingly, a POSITA working with IEEE802.3ah(-Shvodian)-Frei would have had available the relevant information necessary to implement Smith with a

reasonable expectation of success. *Id*. Given the straightforward application of Smith's teachings to the IEEE802.3ah(-Shvodian)-Frei combination, a POSITA would have expected the IEEE802.3ah(-Shvodian)-Frei-Smith combination to be successful.

3. Claim 5

Smith's teachings render obvious Claim 5, which recites "an arrival time of a received packet is measured at 90% of peak amplitude of a received signal, 90% of peak power of a received signal, 90% of total power of a received signal, or a mean delay of a received signal." DISH-1003, ¶¶449-453.

Smith discloses calculating a "relative delay" "derived from," among other things, "***a mean delay*** of the pseudowire packet arrival times." DISH-1009, 6:51-61. It would have been obvious to a POSITA that this claim, which refers to an "arrival time of a received packet" (as opposed to the "transmission time of a transmitted packet" in claim 4) measures an ***upstream*** propagation delay. DISH-1003, ¶¶449-453 Based on this disclosure, a POSITA would have understood that, for purposes of measuring the patent's upstream propagation delay, Smith discloses measuring the arrival time at "a mean delay." *Id*.

4. Claim 4

Smith's teachings render obvious Claim 4, which recites "a transmission time of a transmitted packet is measured at 90% of peak amplitude of a transmission

signal, 90% of peak power of a transmission signal, 90% of total power of a transmission signal, or a mean delay of a transmission signal." DISH-1003, ¶¶445-448.

It would have been obvious to a POSITA that this claim, which refers to a "transmission time of a transmitted packet" (as opposed to the "arrival time of a received packet" in claim 5) measures a ***downstream*** propagation delay. *Id*. As discussed above, Smith discloses measuring the time of arrival according to the mean delay of a received signal. *See* §IV.G *supra*. Accordingly, a POSITA would have found it obvious to measure the downstream propagation delay by measuring the "transmission time" based on the mean delay between two network nodes. DISH-1003, ¶¶445-448.

H. Ground 4B: Claims 14-15, 24-25, 34-35 Are Rendered Obvious by IEEE802.3ah-Shvodian-Frei-Smith

IEEE802.3ah-Shvodian-Frei-Smith discloses claims 14-15, 24-25, and 34-35. DISH-1003, ¶¶454-457; *see also* §IV(G)(1)-(2) (providing overview of Smith and explaining motivation to combine IEEE802.3ah-Shvodian-Frei with Smith). As discussed above, IEEE802.3ah-Frei-Smith renders obvious each limitation of claims 4-5 and IEEE802.3ah-Shvodian-Frei renders obvious claims 11, 21, and 31. *See* §§IV(A)-(D), (G) *supra*. For that reason, IEEE802.3ah-Shvodian-Frei-Smith also renders obvious claims 14-15, 24-25, 34-35. DISH-1003, ¶¶455-457.

V. *FINTIV* FACTORS FAVOR INSTITUTION—§314(a)

Institution is consistent with the Director's guidance on applying the *Fintiv* Factors. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential) ("*Fintiv*"); *Memorandum: Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation* (June 21, 2022) ("*Director's Guidance*"). A holistic analysis of the *Fintiv* framework favors institution. *Fintiv*, 6.

A. Factor 1: Institution Supports Stays in Parallel Proceedings

Institution would enable the Board to determine validity and allow the District Court to stay several litigations involving the '681 Patent. Petitioner will seek a stay, and the opportunity for simplification increases the likelihood the court will grant a stay in view of IPR institution. *C.R. Laurence Co., Inc. v. Frameless Hardware Co., LLC*, 2:21-cv-01334-JWH-RAO (CDCA, Dec. 9, 2022); *Guy A. Shaked Investments, Ltd. et al. v. Trade Box, LLC*, 2:19-cv-10593-AB-MAA (CDCA, Nov. 18, 2020); *Masimo Corp. v. Apple Inc., 8:20-cv-00048-JVS-JDE* (CDCA, Oct. 13, 2020); (all granting motions to stay pending IPRs).

B. Factor 2: The Board's Final Written Decision Will Likely Issue in Advance of Any Foreseeable Trial

The District Court case was filed on February 10, 2023, but due to multiple motions to dismiss, DISH did not answer until September 21, 2023. The trial date

has not been set, and the median time to trial in CDCA for all civil cases is 28.4 months. DISH-1023. For patent cases, that number increases to **34.4 months**. DISH-1025. The August 2025 anticipated Final Written Decision ("FWD") would thus be well before a median time-estimated trial date in December 2025. The District Court set a Claim Construction Hearing for September 17, 2024 and may adjust its schedule to ensure a trial date after the FWD. DISH-1024.

This factor thus favors institution. And even if it did not, "the proximity to trial should not alone outweigh" other factors. *Director's Guidance*, 8.

C. Factor 3: Petitioner's Diligence Outweighs the Parties' Investment in the Litigation

The District Court proceeding is in its early stages, and investment has been minimal. The court has not issued a full schedule, or set a trial date, and claim construction briefing will not begin until July. DISH-1024.

Patent Owner asserted twelve patents, but only ten remain after resolution of DISH's motion to dismiss. Further, Patent Owner's September 2023 infringement contentions first disclosed all asserted claims. This factor thus favors institution. *See, e.g.*, *Apple Inc. v. Seven Networks LLC*, IPR2020-00156, Paper 10 at 11-12 (PTAB Jun. 15, 2020); *Sotera*, 16-17; *Mylan*, IPR2018-01680, Paper 22 at 18.

D. Factor 4: The Petition Raises Unique Issues

DISH asks the Board to consider the unique challenges raised in the Petition, including claims not asserted in the district court.[12] *See Fintiv*, at 12-13. If the Board institutes the pending Petition, DISH will not pursue district court invalidity challenges based on the same grounds in this petition pursuant to 35 U.S.C. §315(e), thereby eliminating any risk of duplicated effort between the District Court proceeding and the IPR.

E. Factor 5: DISH's Involvement in Parallel Proceedings

The parties are the same in this IPR and the District Court proceeding.

F. Factor 6: The Merits Support Institution

The *Fintiv* factors "are part of a balanced assessment of all the relevant circumstances in the case," and "if the merits of a ground raised in the petition seem particularly strong…the institution of a trial may serve the interest of overall system efficiency and integrity." *Fintiv*, 14-15. The grounds raised here are strong, and institution will likely result in invalidation of all claims.

VI. FEES—37 C.F.R. §42.103

Please apply any fees to Deposit Account No. 06-1050.

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12 Claims 4-5, 11-40 are not asserted in the district court.

VII. CONCLUSION

Petitioner requests institution of IPR and cancellation of all Challenged Claims.

VIII. MANDATORY NOTICES—37 C.F.R §42.8(A)(1)

A. Real Party-In-Interest—37 C.F.R. §42.8(b)(1)

DISH Network L.L.C. is petitioner and real party-in-interest. DISH Network Corporation, DISH Network Service L.L.C., and DISH Network California Service Corporation are additional real parties-in-interest. No other party had access to or control over the filing of this Petition, and Petitioner did not file this Petition for the benefit of any other party or entity.

B. Related Matters—37 C.F.R. §42.8(b)(2)

Petitioner is not aware of any disclaimers, reexamination certificates, or petitions for *Inter Partes* review for the '681 Patent.

Petitioner is aware of the following civil actions involving the subject matter for the '681 Patent.

Case Number	Filing Date
Entropic Communications, LLC v. DirecTV, LLC f/k/a DirecTV, Inc. et al., 2-23-cv-05253 (CDCA)	July 1, 2023
Entropic Communications, LLC v. DISH Network Corporation et al., 2-23-cv-01043 (CDCA)	February 10, 2023
Entropic Communications, LLC v. Cox Communications, Inc. et al., 2-23-cv-01047 (CDCA)	February 10, 2023

Case Number	Filing Date
Entropic Communications, LLC v. Comcast Corporation et al., 2-23-cv-01048 (CDCA)	February 10, 2023
Entropic Communications, LLC v. Charter Communications, Inc., 2-23-cv-00050 (EDTX)	February 10, 2023
Entropic Communications, Inc. v. ViXS Systems, Inc. et al., 3-13-cv-01102 (SDCA)	May 8, 2023

C. Lead And Back-Up Counsel Under 37 C.F.R. §42.8(b)(3)

Petitioner provides the following designation of counsel.

Lead Counsel	Backup counsel
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D. Service Information

Please address all correspondence and service to the address listed above. Petitioner consents to electronic service by email at IPR45035-0035IP1@fr.com.

Respectfully submitted,

Dated: February 9, 2024

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CERTIFICATION UNDER 37 CFR §42.24

Under the provisions of 37 CFR §42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* review totals 13,814 words, which is less than the 14,000 allowed under 37 CFR §42.24.

Dated: February 9, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on February 9, 2024, a complete and entire copy of this Petition for *Inter Partes* Review, Power of Attorney, and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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